Welding Engineer

PRICE 50 CENTS

JULY, 1957

miller GOLD STAR SR

PERFECTION in DC welding performance is *here right now!*

This new Miller Gold Star SR *delivers* utterly new standards . . . stands to revolutionize the industry. From its easier starting, smoother — and actually *quiet* — arc, to its increased metal deposition with all electrodes in all positions, the Gold Star SR is a definite milestone in welding development.

Demonstration models are now at your Miller distributors . . . perhaps you owe yourself this final proof of perfection in DC welding.

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APPLETON • WISCONSIN

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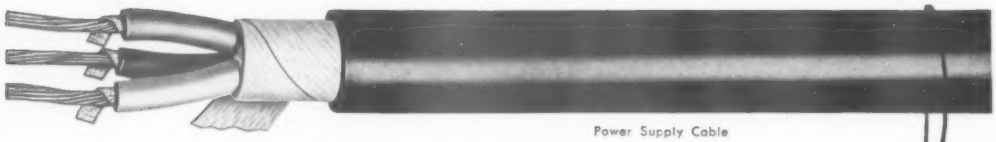
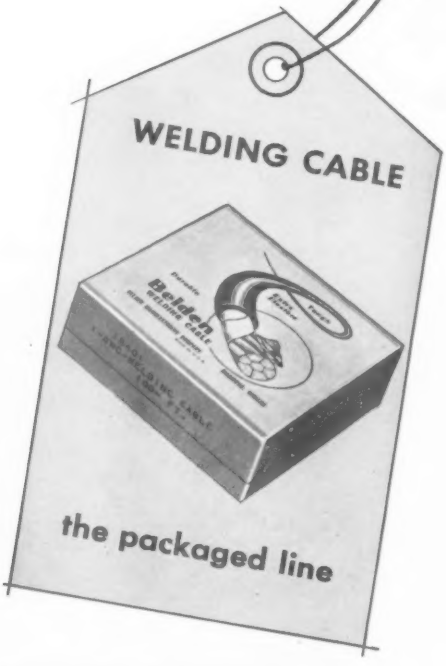
If it's worth engineers' time...



Power Supply Cable

...it's worth engineered cable



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WIREMAKER FOR INDUSTRY
SINCE 1902
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Magnet Wire • Lead and Fixture Wire • Power Supply Cords, Cord Sets and Portable Cord • Aircraft Wires
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Here's a Profitable New **HOBART...**

WELDER COMBINATION

Do Inert Gas ("TIG") Welding or Conventional Metallic Arc Welding, AC or DC

Model ADI-364

Model AD-364

Now you can have your choice of ac welding or dc welding, plus inert gas welding if desired . . . all with remote control! Inert Gas Welding facilities let you weld special and alloy metals as well as regular mild steel. A convenient switch gives a choice of metallic arc welding, tungsten arc welding with continuous high frequency for welding aluminum and similar metals, or tungsten with timed high frequency for welding stainless steel.

With this new Hobart AC/DC unit you can handle jobs that call for either AC or DC (straight or reverse polarity) by merely shifting the convenient selector switch. Versatility is a time saving, money saving feature. And Hobart now gives you another top quality arc welder that is tops in versatility. Write or call today for complete specifications, no obligation.

HOBART BROTHERS CO., Box U-77, Troy, Ohio, Ph. FE 21223

"One of the world's largest builders of arc welding equipment"

This new AC/DC Welder Combination may also be had without the Inert Gas Facilities if desired. Lets you choose either AC or DC metallic arc welding using the new faster welding electrodes.

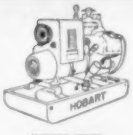
For welder without Inert Gas Facilities, ask for details on Model AD-364.

CHOOSE FROM THE MOST MODERN AND MOST COMPLETE LINE OF ARC WELDERS ON THE MARKET TODAY!

HOBART TROY OHIO WELDERS

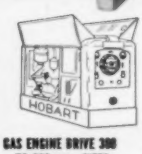
"Contractor's Special" 250 amp., GAS DRIVE

ELECTRIC DRIVE 200 to 600 amp.

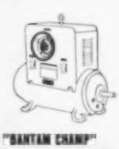


"HUSKY BOY" 200 amp. GAS DRIVE

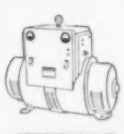
AC WELDER 200 amp. OR AC POWER COMBINATION



GAS ENGINE DRIVE 300 TO 600 amp. SIZES



"BANTAM CHAMP" 250 amp. generator only



CONSTANT VOLTAGE FOR AUTOMATIC WELDING

No. 413 (E-6013)

Hobart's new No. 413 electrode

Fast operating characteristics, wide range of application and a good, penetrating arc make this new electrode easy to use.

The "413" will instantly start and restart, even when partially consumed. For heavy to light gauge mild steels.

TRY THE "413" SOON!

HOBART BROTHERS CO., BOX U-77, TROY, OHIO

Without obligation, send me complete information on:

_____amp. capacity.

- ☐ AC/DC with Inert Gas
- ☐ AC/DC without Inert Gas
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- ☐ "Bantam Champ"
- ☐ "413" electrodes
- ☐ AC Welder—AC Power Combination
- ☐ "Husky Boy"
- ☐ Automatic Welding

Name_____ Position_____

Firm_____

Address_____

City_____ State_____

the NEW all position iron powder mild steel electrode...

HOBART ROCKET 14

. . . that increases production and lowers costs on difficult out of position welding. Here is an iron powder E6013 (Tentative Specs E6014) Electrode that has all the advantages of an ordinary E6013 type . . .

Plus

- **Ability to weld with higher heats**
- **Up to 30% more weld per Electrode**
- **Up to 30% higher deposition**
- **Slag practically self removing**
- **Less spatter**
- **No sticking on either AC or DC**
- **Requires no special technique**

HOBART Brothers Co., Box U-772, Troy, Ohio, *"One of the world's largest builders of arc welding equipment"*

Coupon *brings you full details on ROCKET 14, a faster welding electrode that is sure to cut your costs, especially on out of position welding*

HOBART BROTHERS CO., BOX U-772, TROY, OHIO

Check below for items wanted

- ☐ Send complete details on ROCKET 14.
- ☐ Send complete electrode catalog.
- ☐ Arrange for me to get samples for use on our work.

Name_____ Position_____

Firm_____

Address_____

Welding Engineer

JULY, 1957
VOL. 42—No. 7

THE MAGAZINE OF JOINING
AND SEVERING OF MATERIALS

America's Pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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QUALITY JACKSON PRODUCTS

New 'Quik-Trik' Cable Connectors by Jackson

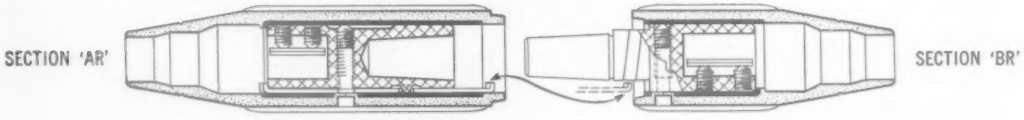
New Neoprene rubber insulators, strongly built around steel sleeves, have tapered ends to stretch over the welding cable snugly. They lock out moisture, oil and dirt, don't catch against obstructions.

Economical to install. No capital equipment is needed, no time consuming vulcanizing. Simply loosen an Allen screw, slide off the insulator and slip it over the cable end. Then connect the cable as usual, either mechanically or by soldering or brazing. Slide back the insulator and tighten.

Model 2/0-R, as illustrated, takes cables 1/0 and 2/0, mechanical, soldered or brazed connection.

Model 4/0-R takes cables 3/0 and 4/0, soldered or brazed connection only.

Section BR (male) of model 2/0-R can be used with section AR (female) of model 4/0-R where the use of different sizes of cables may be desired.



Really 'Quik-Trik'

For a quickly detachable connection, there never was a better metal-to-metal contact than is provided by these smoothly machined tapers drawn tightly together. And now, these new Neoprene insulators are tapered together in the same way. With a twist of the hand, a steel locking bar rides a cam to lock the sections together.

Always fasten section AR (female) to the cable leading from the machine. The live cable end is then well insulated even when detached from section BR (male).

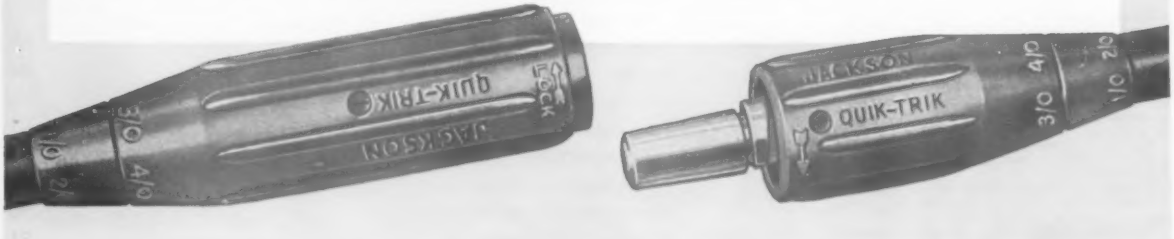
The new Neoprene insulators are recommended for use with the 2/0 and 4/0 Quik-Trik Connectors now in service.

CHECK NOW. Look over your welding cables for costly current leaks and makeshift connections. You'll be money ahead by having Jackson's Ground Clamps, Cable Connectors, Splicers and Lugs stand guard against power losses and accidents all along your cable lines.

Jackson Products

AIR REDUCTION SALES CO., A DIVISION OF AIR REDUCTION CO., INC.

WARREN • MICHIGAN



ABOVE: John A. Hill, president of Air Reduction Co., throws the switch to start the firm's new Chicago plant. Looking on are Reginald Du Bois, Chicago's 9th ward alderman and D. B. Jenks, president of the Chicago Rock Island & Pacific Railroad. RIGHT: The new multi-million dollar air separation plant.

News

Giant machine for Kelvinator

A new 19-station welding and forming machine will take up 150 feet of floor space when it is installed in Kelvinator's main appliance plant in Grand Rapids, Mich., this fall.

At a cost of $725,000, the machine is the most expensive ever bought by Kelvinator. Its special, automated line for production of refrigerator outer shells is one of the first in the industry, says Joseph W. Lelivelt, manager of refrigerated products.

Kelvinator plans to have nearly $4 million worth of new tools and equipment in operation in the plant by fall.

World Congress meet slated for November

Metal scientists from the world over will be drawn to Chicago's International Amphitheatre November 2-8. At least 650, from more than 36 nations, will attend the 2nd World Metallurgical Congress, reports Dr. Zay Jeffries, director of the scientific conclave.

"These scientific sessions will have a bearing on the continued security of the free world," Dr. Jeffries said. He observed that the heavy early response to the meeting indicates the need of a broader, first-hand exchange of scientific know-how in the field of metal.

The meeting will be held in conjunction with the 39th annual National Metal Exposition and Congress; both are sponsored by the American Society for Metals.

Three panel sessions will be staged on ship welding, electrodes and stress relieving, and preheating. At least 18 welding leaders will serve on the panel. The committee is headed by Fred L. Plummer, newly appointed secretary and technical director of the American Welding Society.

Other panelists: Howard Biers, Union Carbide Corp.; Leon Bibber, U. S. Steel Corp.; Harry Schwartzbart, Armour Research Foundation, and William Spraragen, Welding Research Council.

Crucible builds Atlanta warehouse

A new stainless steel sales office and warehouse building in Atlanta, Ga., adds to Crucible Steel Co.'s system of special purpose steel warehouses—reportedly the nation's largest.

Located at 3400 Malone Drive, Chamblee, the warehouses sits on 4½ acres and has 20,000 sq ft of storage area and 5,400 of office space.

Midwest plant for Airco

A shiny new brick and steel building in the Lake Calumet section of Chicago houses Air Reduction Sales Co.'s new air separation plant.

Here Airco turns out 55 tons of high purity liquid oxygen, 15 tons of liquid nitrogen and 3½ tons of liquid argon daily to meet increasing demands of midwest manufacturers. To expand with the demand, the multimillion dollar building was designed for easy enlargement.

Airco's president, John A. Hill, spoke at the May 27 dedication of the new plant, 119th St. and Doty Ave., Chicago.

Weldaloy Products westward bound

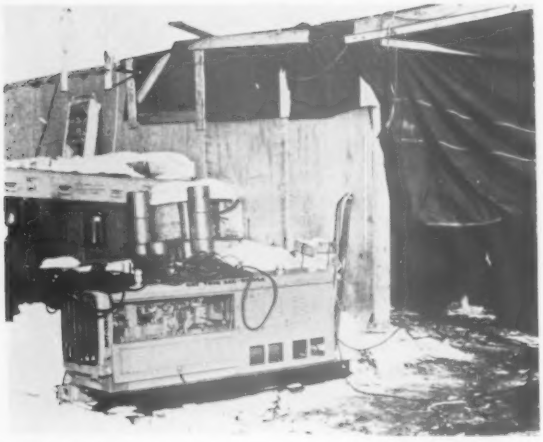
Weldaloy Products Co. recently opened a new branch in Burbank, Calif.

Reportedly the first copper alloying firm to move west, the plant is headquarters for the Weldaloy Western Division. Company president J. A. O'Grady reports that the new division is to serve the automotive, aircraft, appliance and tube and pipe fabrication fields.

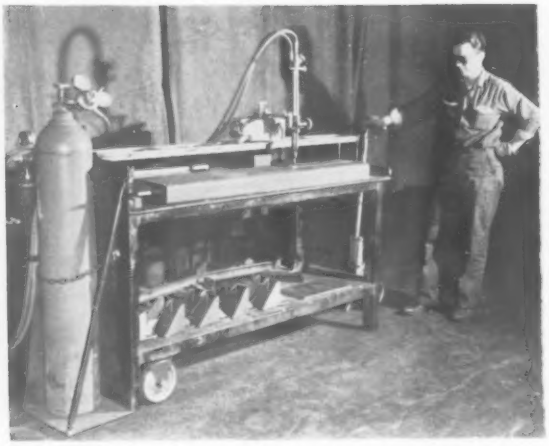
Weldaloy produces copper alloy tube mill electrodes used in electric welding of large and small pipe and tubing and inner and outer conductors for tube mills.

IWDA convenes in Reno

From Alaska and Hawaii and all over, Independent Welding Distributor Association members headed for Reno, Nevada, for their annual two-day meeting, which began June 27.



SEABEES of Operation Deep Freeze—busy setting up scientific research stations in frozen Antarctica—used this Caterpillar twin-arc welder. Skid-mounted, one is located outside the repair shed at Little America.



PORTABLE table carries oxygen-cutting machine to any area of a plant. It is 6 ft long and 3 ft wide. (See story below.)

Tanner, Romano become "Tanro"

Free consultation service is offered by the new Tanro Welding Alloys Co., recently formed by Jack L. Tanner and Frank Romano.

Romano has been chief welding instructor for Eutectic Welding Alloys Corp., and has trained scores of weldors. He has set up training programs in different parts of the globe.

Tanner has been in welding for many years, the past 10 in distribution.

The new company, at 194 Stone Ave., Yonkers, N. Y., will handle a full range of welding equipment, electrodes, gas rods and accessories.

Belden uses slides at national meeting

New "Vu-Graph" slides added the training touch to Belden Mfg. Co.'s National Distribution conference at Richmond, Ind.

The slides are part of a "visual sales meeting" offered by the firm to give salesmen a better knowledge of their product. It is part of the company's 1957 sales educational program.

The theme of the week-long meeting was "Distribution, the key to increased volume." It was directed by Les Thayer, sales manager and Warren Stuart, sales development manager.

Belden's engineering department held discussions on "What's new with the product" each morning. Engineers covered what's new in many fields, including welding cable.

Salesmen gave case-history type discussions on their individual areas in afternoon sessions.

New leasing service for welding industry

A new general leasing service for the welding industry has been started by Liberty Leasing Corp., 341 Madison Ave., New York. It will involve Liberty's purchasing equipment to the user's specifications for long term leases.

Automatic Welding in new plants

Two new buildings in Waukesha, Wis., were recently occupied by Automatic Welding Co., which had been located in Elm Grove, Wis. The new site is east of Waukesha County airport on Highway F.

Plant 1, pictured above, is 50 ft wide and 130 ft long. Plant 2, not shown, is 32 ft wide and 60 ft long. The former serves as the machine shop as well as the assembly plant for "Multimatic" rebuilding machines. Hardfacing and rebuilding of rollers is also carried on here.

Plant 2 serves as the roller assembly area. It is isolated from the rest of the operation as a precaution against dirt, which would harm mechanical components.

New cutting machine adds versatility

With an oxygen-cutting machine mounted on a portable table, mobility and mechanization combine to produce short runs of more than 100 different truck parts.

Diamond T Motor Car Co., Chicago, had previously purchased many of these parts.

The table was designed by Linde Co.'s fabricating department to make mechanized oxygen-cutting available for any location in the plant. It is 6 ft long and 3 ft wide, and has a special platform for oxygen and acetylene cylinders. Two ball-bearing trailer wheels are at one end and a special pin at the other. Using a two-wheel pick-up that engages the pin, the operator can easily move the table.

The cutting machine with torch rides on 6 ft of track 12 in. above the table top. Skids on guide rails at each end of the table position the track assembly.

This permits the quick and accurate repositioning for the line of cut by simply moving the track.

Predict big boom in lithium market

By 1970 American industry will consume over one million pounds of lithium metal annually says Marshall Sittig, president of American Lithium Institute, Inc. Industry will use several times the current production rate.

Lithium is the most rapidly growing member of the alkalis, Sittig

(Continued on page 80)

would you like to know more about this important question . . .

how does a regulator work?

Your oxygen regulator tames a cylinder pressure which may exceed 2200 p. s. i.; it must do so consistently, reliably and safely.

Just how does so sensitive an instrument, so sturdy a regulator, work — what is pressure anyway — wherein lies the difference between a pressure gauge and a tubular flowmeter — when would you select a single and when a two-stage reduction regulator — and wherein lies their difference?

On what basis do you select a regulator to meet specific requirements of low or very high delivery pressures, or minute or very vast volume of flow?

If you have asked yourself these and similar questions about pressure, about the measuring of flow, about all of the many problems your regulator must solve for you, write for this new, FREE National regulator booklet today.

NATIONAL WELDING EQUIPMENT CO.
218 Fremont Street, San Francisco 5, Calif.
Please send FREE "Regulator" booklet.

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BRAZED SUCCESSFULLY

WITH SILVALOY

LOW TEMPERATURE SILVER BRAZING ALLOY

This is Stero's latest customized peg-belt type commercial dish-washing machine, with a capacity of up to 25,000 dishes per hour. It is a beautifully engineered, fully automatic unit that performs dependably and delivers hygienically clean results.

The quality of engineering and construction in all Stero units is unsurpassed. All brazing of tubing and joints in this and other Stero models must achieve maximum strength and be permanently leakproof. This is a Stero standard that is being accomplished successfully with Silvaloy 45 and APW Deoxo Flux.

Silvaloy Brazing Alloys and APW Fluxes are helping to speed production, lower costs and improve brazing results in many fields. Call your nearest Silvaloy Distributor for information or technical assistance.

These two complete reference manuals for low temperature silver brazing and fluxing are available upon request. Send for either one or both.

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APW LOW TEMPERATURE SILVER BRAZING ALLOYS AND FLUXES

ENGELHARD INDUSTRIES

A GENERAL ELECTRIC FIRST . . .

All-Position Welding On Mild Steel with Fillerarc* Equipment

NOW...GET FAST, ALL-POSITION WELDING USING CO_2 WITH EXCLUSIVE G-E FILLERARC GAS-SHIELDED PROCESS

At last, you can weld mild steel with low-cost CO_2 ***without spatter and still get deep penetration.*** General Electric's Fillerarc equipment makes this possible.

Compared with stick electrode welding, Fillerarc consumable-electrode, gas-shielded welding is twice as fast, eliminates spatter, and needs no extra-close fitup. Fillerarc equipment is available for both automatic and semi-automatic welding.

Here are some more important reasons why you can now weld in any position faster and better with Fillerarc equipment:

WELD WITH SMALL WIRE. Fillerarc wire drive *pulls* wire as small as .035 inches into the easy-to-use gun. This size wire tends to kink with push-type apparatus.

SPECIAL REACTOR permits five welding ranges for greater adaptability in all applications . . . plus better quality welds—without spatter.

FILLERARC GENERATOR with rising volt-amp characteristic holds a constant arc length, regardless of changes in current.

For more information about General Electric's semiautomatic Fillerarc welding process, contact your nearby G-E Welding Distributor or Welding Department Sales Office . . . listed in the yellow pages of your telephone book. Or write for bulletin GEC-989, General Electric Co., Schenectady 5, New York. 713-11

EXCLUSIVE FILLERARC WELDING technique is easy to learn. Even your new operators can begin making satisfactory welds in any position in less than ten minutes.

EFFECTIVE ALL-POSITION WELDING with Fillerarc process using CO_2 on mild steel was proved by demonstration at recent AWS Show. Ask for your demonstration today.

*Reg. trade-mark of General Electric Co.

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GENERAL ELECTRIC

Tough! as they come

ATLAS TOMAHAWKS

Biggest sellers in the Atlas line—All-steel
"Rebit" replaceable bit Tomahawks with steel handles
"Dual Tools" Tomahawk and brush with and without replaceable bit
One of a big selection of Atlas wood handle Tomahawks
Atlas quality in low cost all-steel Tomahawks

Ask your welding supply dealer to show you the Atlas line

They ask us: WHY 30 MODELS?

We Answer: —because weld cleaning jobs offer such a wide variety of problems—because welders have strong preferences for certain tool styles. Atlas has made a sincere effort to provide you with the tool you want regardless of your likes and dislikes, in ATLAS QUALITY!

ATLAS WELDING ACCESSORIES INC.

707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.

Letter should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Coded v. Non-coded

Dear Sir:

I have been an ardent reader of *The Welding Engineer* for quite some time and have benefited from the vast store of knowledge and facts you have published in so clear and concise a manner.

In the May *Welding Clinic* you said: *There seems to be no reason why a weldor should receive premium wages for non-code work in those areas where code work does draw a premium.* I believe you have made a grave error and have done a great injustice to non-coded weldors, made up largely of maintenance and tool and die weldors.

I work as a maintenance and tool and die weldor in an aircraft plant where 97% of the weldors are code weldors.

The maintenance weldor must be able to weld cast iron, aluminum and alloy steels. He must be an inventor. He must know metallurgy and blacksmithing. Code weldors generally know but one trend of welding.

The tool and die weldor, in some cases, must use the atomic hydrogen process. He must know the types of tool steels and preheat temperatures, types of tool steel rods best suited for the tool, and what it is to be used for. He must know jig and fixture building and how to counteract warping in weldments. Few code weldors know all this.

A code weldor generally is a production weldor in the field or in a factory. His knowledge is limited because he usually has ready-made jigs and a set-up man to line up parts. All he must do is weld it.

The maintenance and tool and die weldor must be able to do all types of welding, do his own thinking and rectify his own mistakes.

I hardly think that there is any question of which weldor has the greater knowledge and I believe he should be paid accordingly.

A California weldor

HAYNES Alloys solve the *tough* wear problems

NO MAINTENANCE FOR 2 YEARS

Trouble-free mining operation in abrasive muck with HAYNES Alloy

Ordinary bearings and rollers couldn't take this punishment and lasted about 3 weeks. But when these rollers were built-up and hard-faced with HAYNES STELLITE alloy No. 6, service life was extended to years instead of weeks!

Whether your equipment handles rock, sludge, or acid—where there's a serious wear or corrosion problem, you will find that a HAYNES alloy will reduce maintenance and replacement costs. For complete information about hard-facing, write for the Hard-Facing Manual. Address HAYNES STELLITE COMPANY, Division of Union Carbide Corporation, Kokomo, Indiana.

Constantly and completely covered with abrasive muck. This equipment, deep in the mine, gathers and transports ore at the digging sites. Parts were hard-faced right on the job—almost 600 ft. below the earth's surface—with HAYNES STELLITE alloy No. 6 rod.

HAYNES ALLOYS

HAYNES STELLITE COMPANY

Division of Union Carbide Corporation

Kokomo, Indiana

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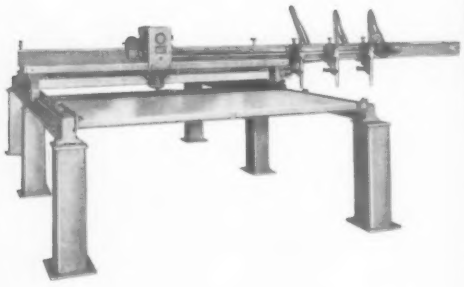

HANDS OFF!

Illustrated below are some examples of intricate shapes cut by the BURDOX Statosec Shape Cutting Machine.

BURDOX
STATOSEC
cutting machine does its own thinking for you!

The amazing BURDOX Statosec Shape Cutting Machine with Photoscope Electronic Tracer *automatically* reproduces the most intricate pattern! A low cost cut-out or drawing is the only pattern necessary. Accuracy is so precise that machining of finished pieces is often unnecessary.

Steel warehouses, car shops, fabricators, tank shops, die shops, or any plant cutting metal can utilize Statosec for economical reproduction of intricate shapes even from small pieces of plate or for stripping extra long plates. A varied range of heads cover any possible application.

Send coupon for complete details.

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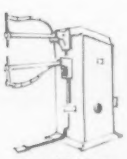


Spot Welding Equipment

Soldering, Brazing Equipment

Safety Equipment

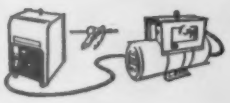
Cutting Equipment

Accessories

JULY
1957

Your *WeldWorld* at press time

Last minute news of interest to those engaged in joining and severing materials.



..New secretary of the American Welding Society is Fred L. Plummer, a past president. Plummer also takes on added duties of technical director. He had been director of engineering for Hammond Iron Works, Warren, Pa. Selection of Plummer came as a surprise to many members.

..Consultants: Welding Engineer wants information about you for its files...WE is compiling a confidential directory of consulting welding engineers. Write to: Research Dept., Welding Engineers, Welding Foundation, Box 28, Morton Grove, Ill.

..Argon shortage should be easing, now that Linde strike has been settled. Most of the Oil, Chemical and Atomic Workers returned to their jobs with pay increases averaging around 13 cents an hour.

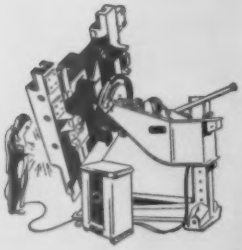
..Scientists at Armour Research Foundation, Chicago, have developed a method for making titanium tetrachloride at temperatures much lower than presently used—and with higher purity and at less cost. Compound is necessary in manufacture of titanium.

..du Pont has cut titanium sponge prices 5 cents a pound. Earlier, Titanium Metals Corp. of America made an average 10% reduction in cost of titanium bar, billet, wire, plate, extrusions, and non-alloy grades of sheet and strip.

..Grinding Wheel Institute has issued new standards of practice for shape types and sizes of grinding wheels that currently are in general production and demand. Copies are available from the Institute.

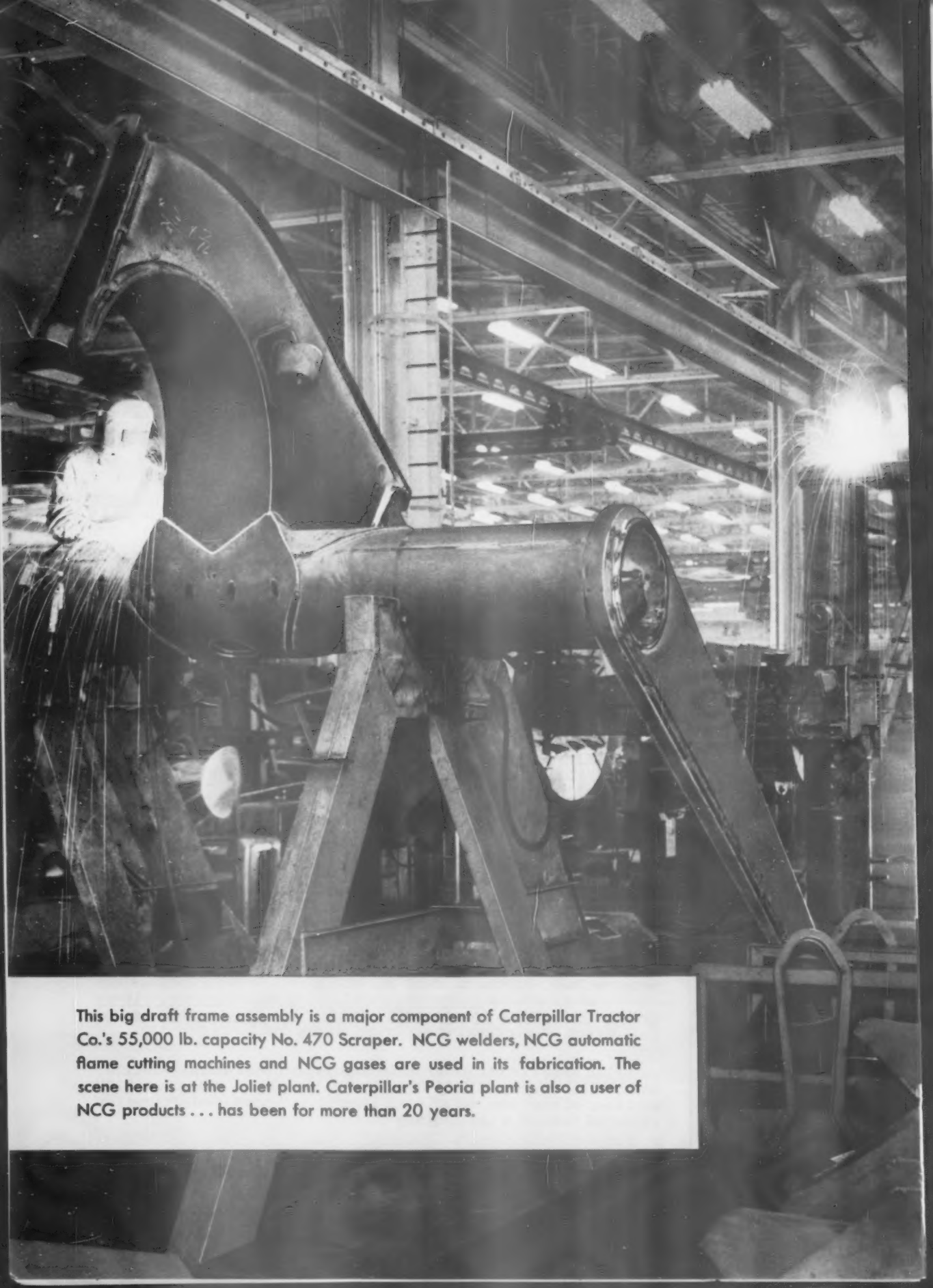
..Wraps were recently taken off a Machine Welding Dept., inaugurated by Air Reduction Sales Co. some time ago. It offers complete machine welding engineering service—from selection of process to delivery of custom-tailored equipment package. Airco has engineered 36 such installations in customer plants.

..Three Chicago banks unanimously foresee a leveling in business activity that should continue for the next few months. Federal Reserve Bank, Northern Trust Co. and Harris Trust & Savings are the firms reporting decreased residential construction, slower growth in capital investments, decreasing inventories—sound indicators of slackening activity on the business front.



..Sealed bids for the government magnesium plant at Painesville, Ohio, will be opened July 23. Bids on the plant, valued at $15½ million, closed two weeks ago. General services administration rejected bids at a letting May 10.

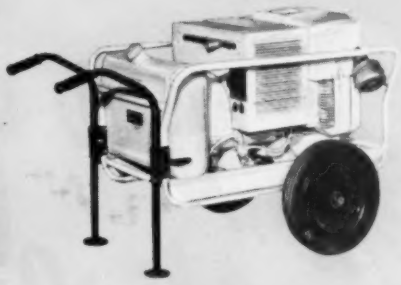
..American Iron & Steel Institute reported steel production of 9,808,000 net tons for May. Steel output for first 5 months of 1957 now totals 51,207,822 net tons—down over 1½ million tons from 1956.



This big draft frame assembly is a major component of Caterpillar Tractor Co.'s 55,000 lb. capacity No. 470 Scraper. NCG welders, NCG automatic flame cutting machines and NCG gases are used in its fabrication. The scene here is at the Joliet plant. Caterpillar's Peoria plant is also a user of NCG products . . . has been for more than 20 years.

Sureweld® A-C SHOP WELDERS—For general repair and light production work. 3 models.

Sureweld A-C INDUSTRIAL WELDERS—For heavy duty production welding. 10 models.



Sureweld D-C PORTABLE WELDER—Gas driven welder for field welding and maintenance work.

Bring on ANY welding job!

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Sureweld INERT ARC WELDERS—For tungsten electrode inert-gas welding. 3 types, 31 models.

Sureweld A-C D-C WELDERS—For all arc-welding jobs—A-C or D-C of either polarity. 6 models.

Whatever the type you need, whatever the capacity, there's a *SUREWELD* welder to do the job better. Each has superior features that distinguish it from other makes . . . features you'll like, features your operators will like. Check the design, the construction, the performance, the easy operation, the power consumption. Get the facts today. Your NCG dealer or nearest NCG office is ready to serve you.

When you work with metals . . . work with

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No matter what the job . . . in cutting, welding, brazing, or metal conditioning . . . NCG has the equipment, the experience and the organization to serve you better.

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Better Welding!

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—three magnet frame pieces of different thicknesses, projection welded in one operation

Improved non-synchronous performance with Square D's NEW SLOPE CONTROL

BETTER AND MORE PROJECTION WELDS through more uniform distribution of welding current.

PERMITS WELDING NON-FERROUS METALS. Reduced "spitting" at electrodes improves appearance of aluminum and other non-ferrous welds—extends electrode life.

DESIGN FEATURES

Matched Enclosures. Slope Control enclosure matches Square D Non-Synchronous Welder Controller (Nema N2), shown at right. Also matches individual Square D welding timer or contactor enclosures.

Simplified Circuit, standard components, and heavy-duty construction.

Write for Bulletin 8990 EWG. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.

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Up & Down
Slope

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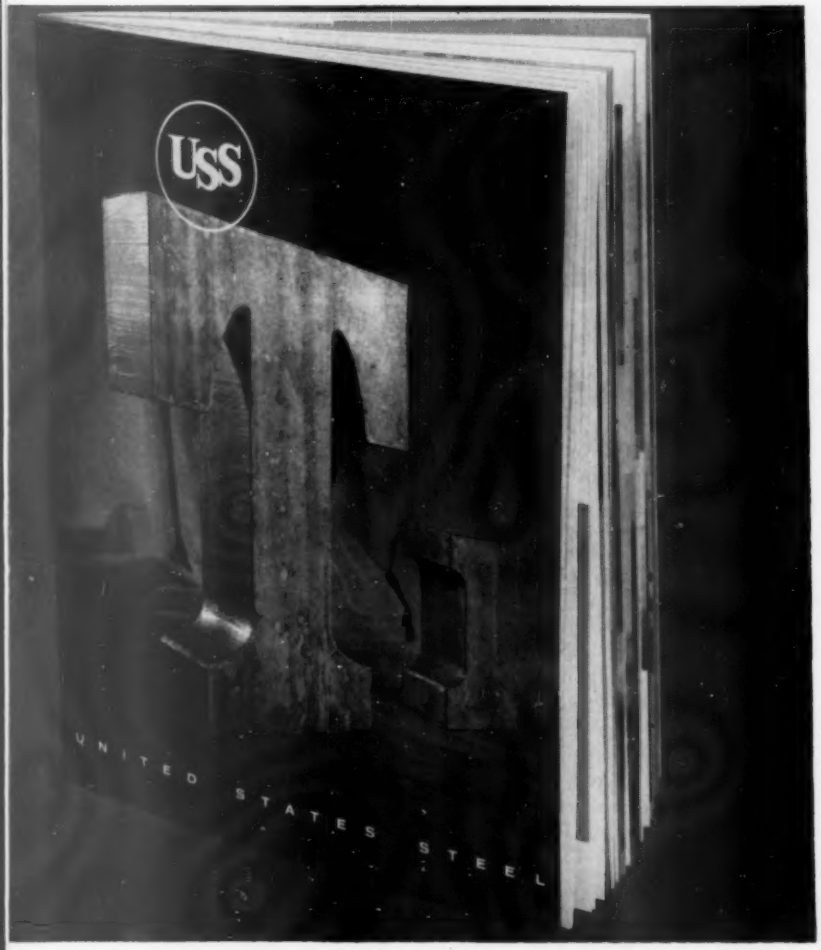

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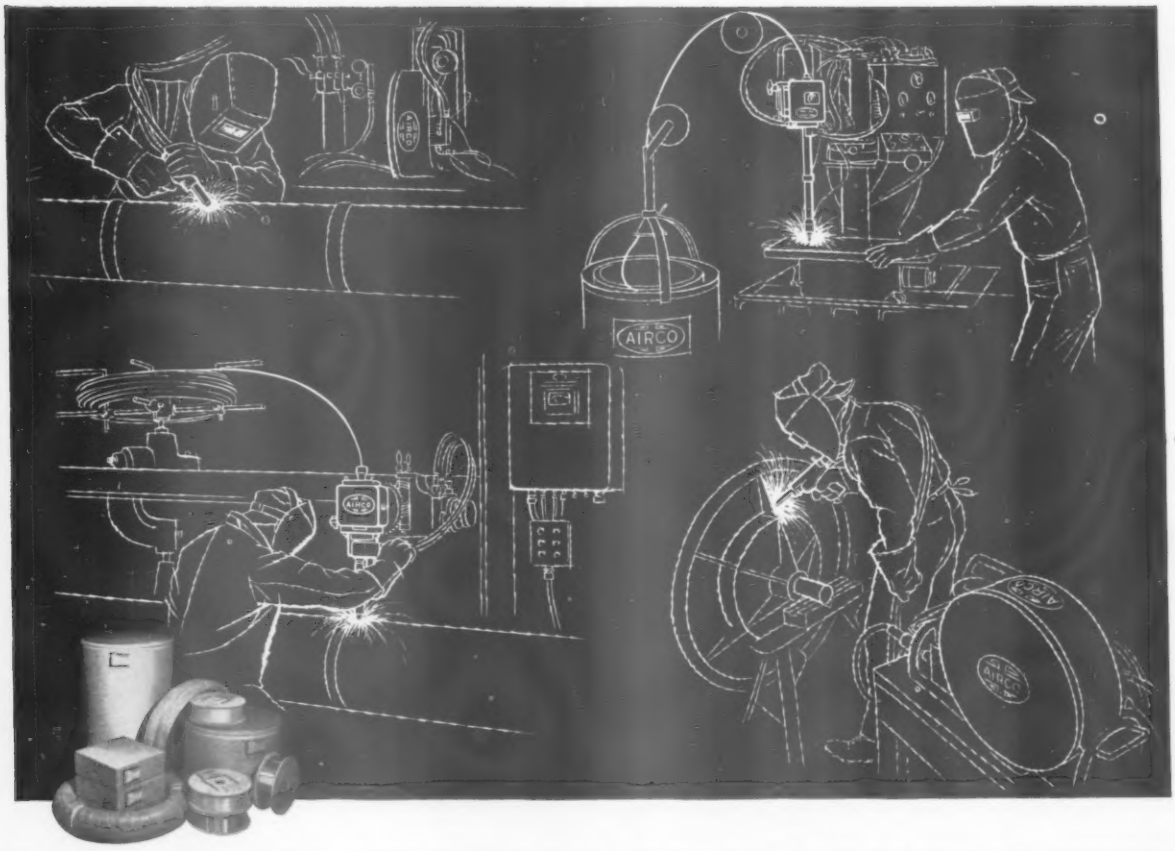

THE WIDEST SELECTION OF AIRCOMATIC® WIRE

for any kind of inert gas welding

Successful Aircomatic welding and Heliwelding (where filler metal is required) depend on using the correct wire. Airco can supply the widest variety of wire types and diameters — all specifically designed for use with these inert gas shielded welding processes. All Aircomatic wires meet rigidly controlled specifications as to chemical analysis, surface finish, purity, cast and packaging.

Pure . . . properly cast . . . level wound

Aircomatic Aluminum Welding Wires. New Type A finish available for all high-quality work where X-ray standards must be maintained . . . scrupulously clean . . . bright finish . . . properly wound . . . smooth surface assures trouble-free feeding.

Aircomatic Stainless Steel Welding Wires . . . excellent corrosion resistance . . . good tensile, ductility and impact properties . . . use to weld ordinary joints, apply stainless linings, build-up stainless overlays and join stainless overlays and join stainless clad materials.

Aircomatic Copper and Copper Base Alloy Welding Wires. Use to assemble copper bus bars . . . fabricate copper or bronze vats . . . build-up worn propellers, piston and valve parts . . . available in both solid and stranded types.

Aircomatic Steel Welding Wires. Three grades available for welding mild steel, armor plate and for overlays and welding hardenable steels.

Nickel base, magnesium, and titanium wires are supplied as specials. Consult your nearest Airco Office or Authorized Airco Dealer for complete information.

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BETWEEN PASSES

meet the press

We'd like to take this opportunity to introduce two new members of our editorial staff. Shirley Gaghen and Fred *(Fritz)* Foerste recently joined the *WE* team as assistant editors. Shirley, a graduate of the University of Illinois, comes to us after a year's stay in Boston. Fritz, who was graduated from Miami University at Oxford, Ohio, comes to Chicago after a teaching stint in Idaho high schools. Both joined us just before we moved to our new headquarters in Morton Grove, a suburb north of Chicago. In case you haven't seen it elsewhere, our new mailing address is P. O. Box 28, Morton Grove, Ill.

how true!

Our recent editorial, as well as the comments on this page about too many conventions, brought to mind a quip credited to Russell Anderson of McGraw-Hill's International Dept., to wit: "The road to hell is paved with good conventions."

new steel

An ultra-high-strength steel has been experimentally produced by the Commerce Dept.'s National Bureau of Standards. Developed by Samuel J. Rosenberg and Carolyn R. Irish of the thermal metallurgy laboratory, the steel can be heat treated to an ultimate tensile strength of 285,000 psi, with sufficient ductility for structural applications—yield strength is 235,000 psi. The bureau reports it is made by normal melting and working processes and should not be difficult to manufacture. Although many steels can be heat treated to strengths of 300,000 psi and higher, they are normally quite brittle at these levels.

don't forget welding

A top officer of a large international firm recently delivered a talk on the coming acendancy of new alloys and how they will be used in manufacturing missiles and rockets. We weren't able to cover the speech, but in reports we have received, Mr. X failed to mention the means of fabricating these space vehicles. Seems to us that with all this talk about super alloys, someone might put in a plug for welding. With what other means could fabricators possibly achieve the smooth skins necessary for the speeds at which these vehicles will travel?

consultants

In case you missed our request in this issue's *WeldWorld*, we will repeat that *WE* is compiling a file of consulting engineers. If you're in this category, please send us the facts about yourself and your specialties, on your letterhead. Address your data to Research Dept., *Welding Engineer*, Welding Foundation, P. O. Box 28, Morton Grove, Ill.

overseas visitor

A recent visitor to *WE*'s offices was Don A. Tibbenham, head of a London advertising agency and son of a British welding authority. Following his visit to *Welding Engineer*, Mr. Tibbenham was interviewed by the Chicago *Tribune*. He told the newspaper that "American advertising may be far ahead of England's as far as technique is concerned, but in originality, the British have the edge."

new products

According to the Small Business Administration, about 80% of our present economy is based on products that did not exist 75 years ago . . . this despite the fact that 90% of the new products *fail* to win customer acceptance. *WE* can vouch for the importance of new products and the interest shown in them—our inquiry department is swamped every month with requests for more information on products described in these pages.

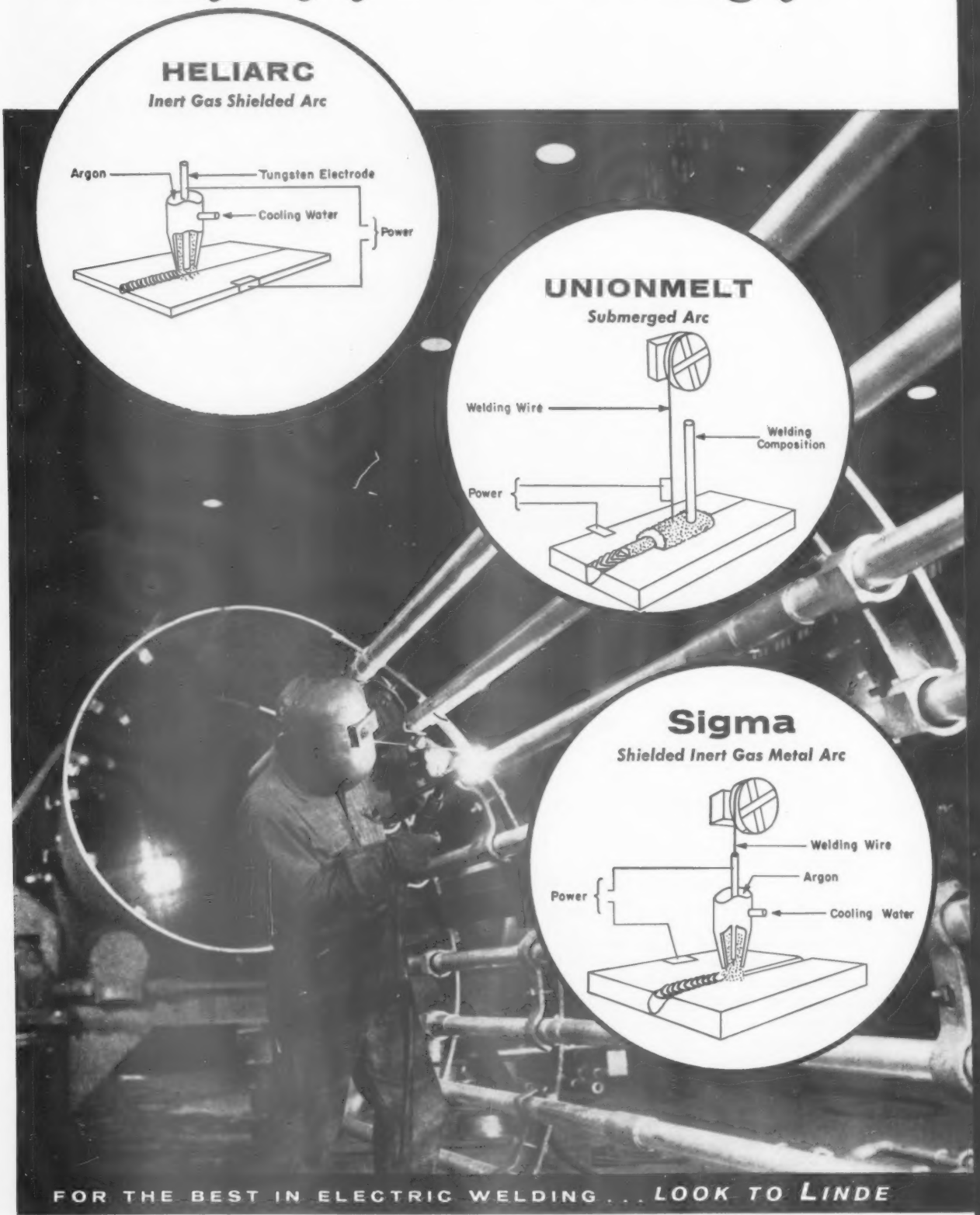
some luck

Some people have all the luck. Gracing the boss' desk is a small welded sculpture he won at the welding show. Yes, Ted was one of the winners of drawings held by Linde at its booth. The small bronze figure of a bull is the work of Ernesto Gonzalez, Cuban sculptor, who was one of the Linde attractions in Philadelphia.

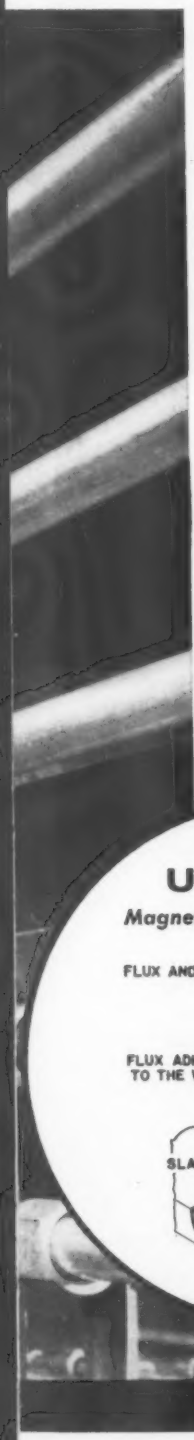
a promotion

Recently ordained a priest was one of *WE*'s most faithful readers, Father Mathias of the abbey of Our Lady of New Melleray. In its September, 1956, issue (p. 33) *WE* described the inventive work done by weldor monks under the direction of the then Brother Mathias.

For any of your welding jobs



. . . LINDE can supply the *right method!*



Inert gas shielded arc welding—

HELIARC Apparatus for inert gas shielded arc welding, using a tungsten electrode and a shield of LINDE argon, is tops for joining hard-to-weld commercial metals. On stainless steel and aluminum, HELIARC Welding is fast and clean, producing high-quality welds that resist corrosion. HELIARC Welding eliminates costly grinding and finishing, making it a valuable method for quantity production of hard-to-weld metals.

Submerged arc welding—

Shapes made of materials ranging from light gage to heavy plate, adaptable to mechanization, can be most economically joined by UNIONMELT Welding. It is used on low and medium carbon steels and alloy steels, including those containing chrome and/or nickel. UNIONMELT Welding is also used extensively for resurfacing metal, providing extra wear and corrosion resistance. UNIONMELT Welding is fast and inexpensive on production jobs.

Shielded inert gas metal arc welding—

One of the most versatile welding methods is Sigma Welding. LINDE's Sigma apparatus, using a shield of LINDE argon, is ideal for manual welding of commercial metals ⅛ in. or more thick, and for automatic operation on lighter gage metals to .050 in. Highest quality welds can be made on aluminum thicker than ⅛ in. at speeds up to 16 inches per minute. Build-up and surfacing jobs are also improved by using LINDE's Sigma welding method.

New! Magnetic flux gas shielded arc welding—

UNIONARC Welding, LINDE's most recent development in electric welding, is an extremely fast method for welding mild steel. This method employs a continuously-fed, bare steel wire electrode, magnetically coated with flux conveyed in a stream of carbon dioxide shielding gas. Manual welds can be made easily in any position—vertical, overhead, downhand—with no stops to change electrodes. The speed, versatility, and ease of operation of of UNIONARC Welding brings costs down 25% to 65% below those of manual covered electrode welding. Clean, smooth, high-quality welds are provided, even in the presence of moderate amounts of rust, scale, and moisture.

Engineers at LINDE have been designing, developing, and testing electric welding methods and apparatus for many years. Help on any welding method is yours for the asking. You can improve your work and cut production problems by taking advantage of LINDE's experience. For data on UNIONARC Welding or any other electric welding method, call the LINDE office nearest you.

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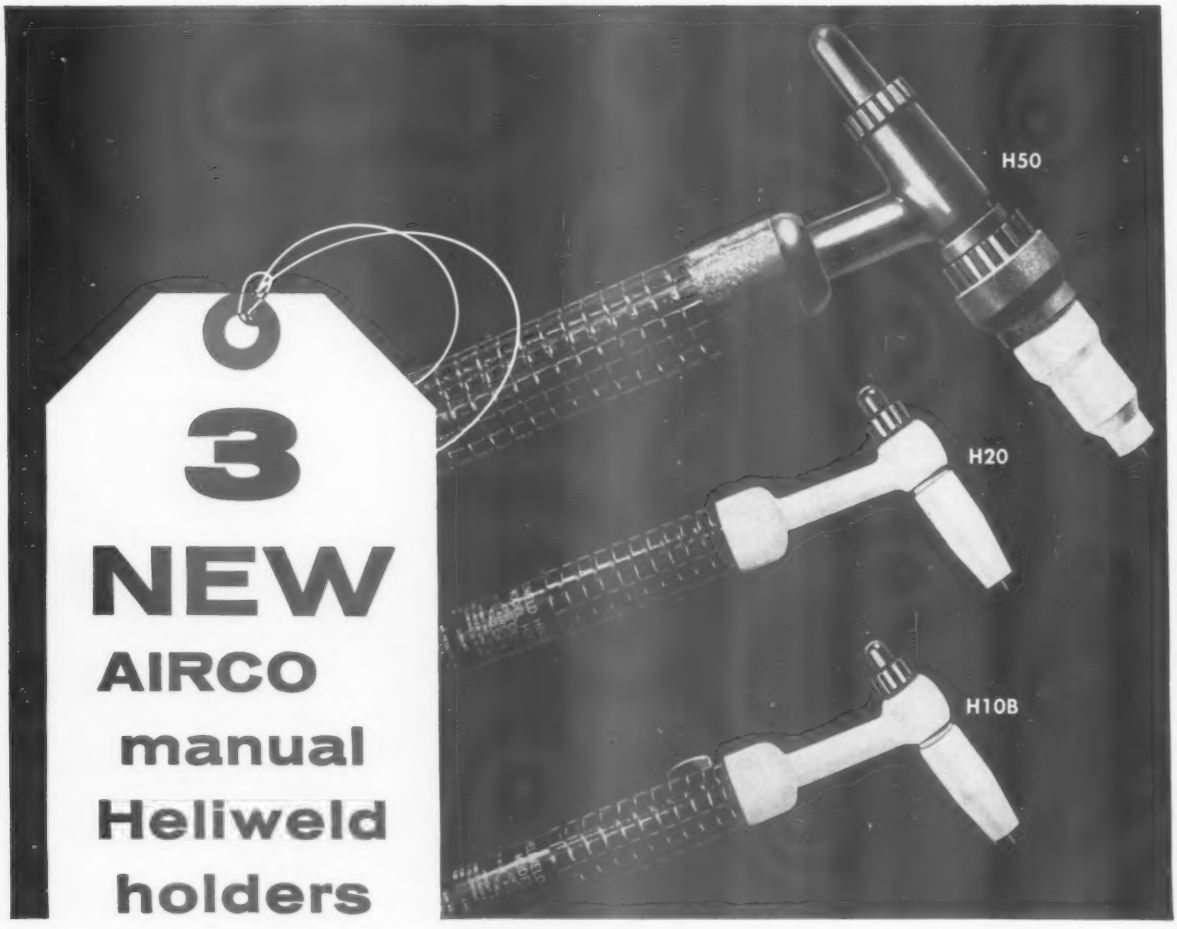

3 NEW AIRCO manual Heliweld holders

for greater flexibility in tungsten arc welding

Wider and higher current ranges of these three new Heliweld holders add a new measure of versatility in the welding of thin gauge sheet aluminum, stainless steel, copper base alloys, magnesium and killed steel.

Water-cooled H50 Heliweld holder has a continuous duty rating of 500 amps DC and 350 amps AC. New nozzle and holder design provides efficient gas coverage at reduced gas flow . . . costs less to operate. Stub loss only 1¼". Parts interchangeable with M50 machine holder.

Water-cooled H20 Heliweld holder has a continuous duty rating of 200 amps, AC or DC, yet is only 7¾ inches long; weighs 4 ounces. Compactness of the welding head makes the H20 ideal for welding in tight corners. Parts interchangeable with the H10.

H10A and H10B Heliweld holders, both air-cooled, have continuous duty ratings of 100 amps, AC or DC. The H10B holder is the *only* unit on the market that has a thumb-operated gas valve on the handle for greater gas savings.

For complete information consult your nearest Airco Office or Authorized Airco Dealer.

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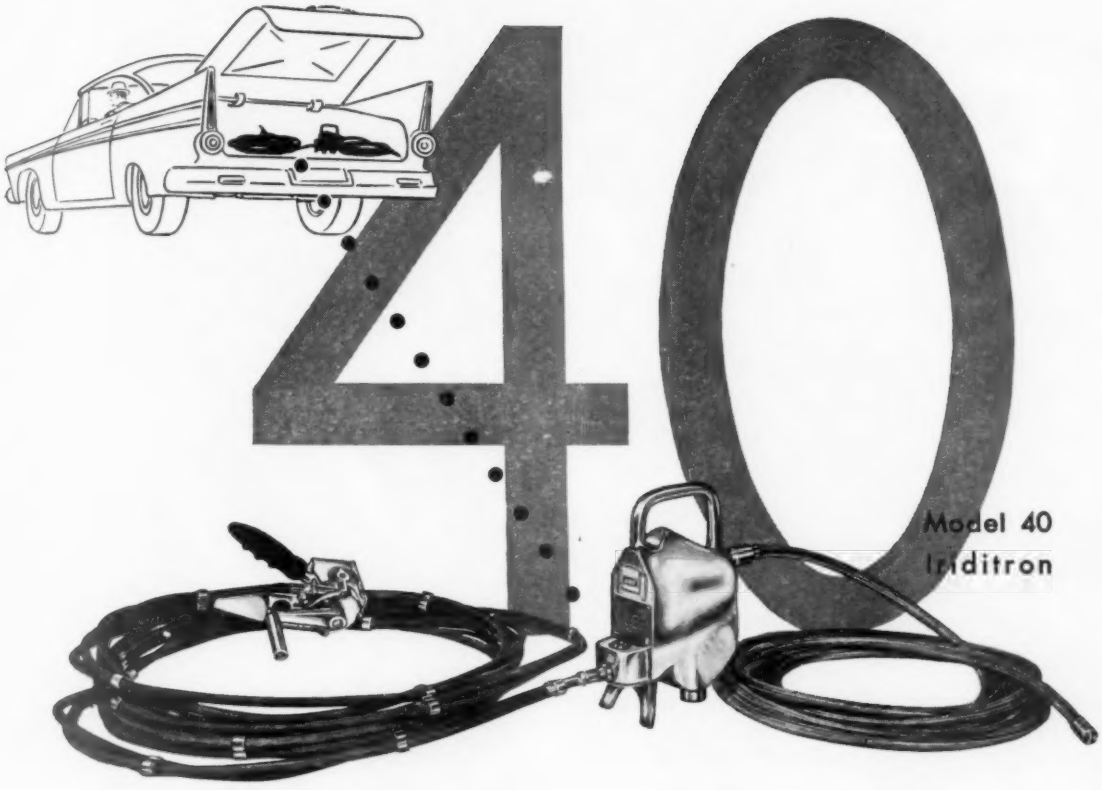

LOW COST . . . LIGHT WEIGHT . . . PORTABLE

The Model 40 Iriditron, an isotope radiography machine capable of containing 30 curies of Iridium 192, is the lightest unit manufactured that can make panoramic exposures at a distance. It is especially designed for exposures which cannot be made conveniently with X-Ray equipment.

Weighing only 40 pounds, it is readily portable and is compact enough to be transported in the trunk of a car.

The Iriditron also stores the source when not in use and the shielded head serves as a shipping container.

Nuclear Systems has a versatile line of remote handling equipment for the safe exposure of strong gamma sources . . . for every radiography job.

NUCLEAR SYSTEMS
A DIVISION OF THE BUDD COMPANY, Philadelphia 32

Budd

"POURING IT ON"—
with Iron-Powder Electrodes

High-production *quality* welds are easy for the operator who uses P&H Iron-Powder Electrodes. Powdered metal in the coating raises thermal efficiency, providing speed of deposition and bead smoothness that approach submerged arc welding.

Typical applications include railroad cars, construction equipment, bridges, shipbuilding, foundry equipment, tanks, and piping.

Write for Bulletin R-29, "P&H Smootharc Welding Electrodes," for full description and specification data. Address Dept. 312B, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

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MILWAUKEE 46, WISCONSIN

JULY, 1957

Welding Engineer

ESTABLISHED 1916

Is blackmail a heritage?

THIS MONTH we intended to devote this page to the topic of WELDING ENGINEER's move to new quarters in the Welding Foundation Building, Morton Grove, Ill. By the time you read this editorial, we should be settled in this new location—one which will greatly assist us in doing an even better job for you.

We will postpone discussion of this new publishing center, however, because we feel the July editorial should be dedicated to the birth of this great country.

We're living high, wide and handsome in the U. S. today—but not because we are smarter, work harder, or have greater natural resources than anyone else. We enjoy our good life because we make more effective use of our energies. The freedom to perform this very natural act was envisioned in a Declaration of Independence framed by wise men 181 years ago. Later, as leaders of a new country, these men perpetuated this cherished freedom in a constitution.

It is a pity that recent government leaders have not been instilled with the same desire to keep us free and great!

Technological advances would make it difficult for the freedom authors of 1776 to recognize their country today. And recent governmental actions might completely obscure their magnificent creative efforts which give us cause to celebrate each July.

LITTLE did the Founding Fathers dream that one day the Supreme Court and the President would take over the functions of Congress. These men defined the *separate* functions of the government's executive, judicial and legislative branches. Yet we now see the Supreme Court voiding portions of our Constitution as it pertains to states rights, and to the investigative powers of the government. Such actions give great comfort to enemies working within the government to destroy our free way of life.

Presidents in recent years seem to have proclaimed nearly as many laws by "Executive order" as there have been laws enacted by Congress. Many of these orders have seriously curtailed freedoms granted by the Constitution.

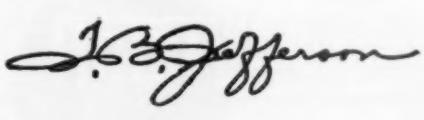
What would Thomas Jefferson say about the actions of a predecessor who surrenders a soldier to foreign justice when the man kills a thief in the line of duty? And what would the man from Monticello think of a President who says: "If Congress won't give me all the money I ask for, I'll not be responsible for the safety of this country"?

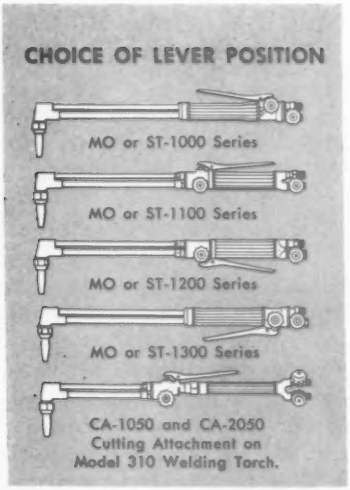
IN 156 years, government tax collectors (even during two of the most costly wars in history) received $244 billion. Then along came a President whom we thought to be the "King of Taxers," and in a little over 7 years he grabbed $342 billion. But he seems to have been a piker; we now have a President who proposes to collect $373 billion in 5½ years.

Much of our world today seems to be run on the basis of international, national and local blackmail. Foreign nations retain open relations with a potential enemy, yet continue to receive billions in U. S. foreign aid under threat that they may "turn communistic" if dollars are not forthcoming.

On the national level we have super-professional tax collectors, and even on the local level—affecting every welding shop and welding supply distributor—the bitter pill of blackmail must be swallowed. Goods cannot be delivered in certain circumstances unless truck drivers belong to a particular union. Machines designed to reduce labor requirements all too often require the "supervision" of an extra worker. And distributors must go along with dubious advertising schemes because "you'll be sorry if you don't."

Could these practices have been envisioned by the brave men who risked their lives and their possessions to sign an historic document on July 4, 1776? We think not.





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WELDOR Mark Daniells Mig welds aluminum bridge section in Carter Bros. yard. Welding wire reel is mounted on swing boom and counter-balanced with cooling water recirculating unit. Cut-down truck chassis provides portability for welding operation.

It was a question
of hauling gravel 2 miles or 180 ft.
Forwell Sand and Gravel Co., Ltd.,
naturally chose the shorter distance
and paved the way
for a distinctive
Mig welding application.

North America's first tubular aluminum bridge

By T. B. Jefferson

ENGINEERS have long known that nature was right in making our bones tubular members, for tubes are both strong and light. They give us the best possible weight-strength ratio regardles of our size.

Until welding came along, it was difficult to join metal tubes satisfactorily. Even today, some engineers are reluctant to take advantage of tubing's weight-saving possibilities because they refuse to give welding a try. This is not the case, however, with W. R. Petri of Galt, Ontario.

As a designer of German aircraft structures in World War, II, Petri was thoroughly familiar with the use of welded tubular members. And it was his knowledge of the severe stresses and strains imposed upon welds in military aircraft that led to his confidence in welded joints.

Airborne to Earthbound

Aircraft design poses many structural problems, but their satisfactory solution is evidenced by the great number of planes in daily use. Since he first began to work on these structures, it was one of Petri's ambitions to incorporate his knowledge of airborne structural frames into earthbound constructions.

Why not a welded tubular bridge?

To Petri, this semed to be a good starting point. But if steel members were used, internal corrosion of tubular members would always be a problem. Petri felt he had a solution in the use of aluminum tubing.

But who would build—or who would buy—a tubular aluminum bridge? In the summer of 1956, there came an opportunity to answer both questions.

Forwell Sand and Gravel Co., Ltd., of Breslau, Ont., realized at this time that it would soon have to open a gravel pit across the Grand River from its present operation. Though the river was only 180 ft wide, the new gravel pit would be two miles away by truck.

A four-mile round trip for a truck load of gravel is an expensive and time-consuming operation. So Forwell sought another solution for gravel transportation from the pit to the washing and grading plant.

Initially, it was felt that a logical solution would be a two-span bridge with 90-ft spans. Forwell soon learned, however, that permission to cross the Grand River would be granted only on the condition that the bridge be a single-span type not less than 180-ft in length.

Weight of a steel bridge strong enough to carry a conveyor would be approximately 30,000 lb—a lot of steel to support a live load of only 10% to 20% of that weight. It was at this point in planning that Petri

presented his idea for a welded aluminum bridge. As a consultant for Carter Bros., Ltd., of Waterloo, Ont., he knew his firm was well qualified to do the job.

Petri calculated that a 9,000-lb aluminum structure would support a live load of 60% it own weight. This lightweight bridge would mean smaller piers and, once it had been built, would practically eliminate maintenance problems (aluminum structures do not require painting.)

Forwell Co. was familiar with the work of Carter Bros. Some gravel trucks has beeen fitted with aluminum dump bodies by Carter, and the Waterloo fabricator had conducted welding maintenance and construction operations around the gravel plant.

Forwell agreed to the idea of a tubular aluminum bridge because of the cost savings it offered. Before long, one of the most unusual bridge fabrication jobs in North America was under way.

Modified Double Truss

Since minimum length of the bridge had been specified as 180 ft, Carter decided to build a modified double Pratt Truss structure of this length. It would be 16 ft high and 9 ft wide between centers. Members were spaced at 6-ft intervals to allow use of a jig for all diagonal members in the vertical and horizontal planes.

Material chosen was Alcan 65 S-T. To avoid special tooling, it was decided to use tube diameters for which dies were available at the Kingston plant of the Aluminum Co. of Canada.

Tube diameters were carefully calculated to get lowest material cost, considering the price reduction for greater quantities against increased weight of material. The final design specified eight tubing sizes for the bridge structure, with one other tubing size and a channel section for carrying conveyor rolls.

Various sizes of tubing used were:

6 in. x 0.25 in.	**3 in. x 0.120 in.**
5½ in. x 0.238 in.	**2¾ in. x 0.083 in.**
5 in. x 0.102 in.	**2½ in. x 0.065 in.**
4 in. x 0.120 in.	**1¼ in. x 0.065 in.**

A heat-treated alloy, Alcan 65 S-T loses strength when annealed by welding heat. To overcome this problem, and to provide best possible joint design, Alcan provided the Carter firm with previous test results obtained in welding this material. Alcan also generally tested and evaluated specimens developed by Carter.

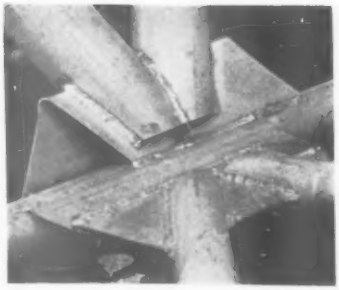
Cruciform Joint

As a result of test studies, Carter decided the best form of butt joining main members was the cruciform *(see photo)*. For joining diagonal members to main tubes, a unique "tent" was developed (Carter Bros. and Petri have made patent applications for this method).

The tent, like the cruciform, anneals only a small part of the circumference of the main tube because welds are parallel to the main tube axis.

Because of the critical nature of the job, all welding was done by one man, Mark Daniells of Waterloo, a Carter employee.

Since it was easier to move the finished bridge to the site than to move all necessary fabricating equipment, all welding was done in the Carter Bros. shop. Shop space and transportability requirements necessitated



UNIQUE tent joint where welds join diagonal members to main tubes. Patent application has been made for this joint type.

CRUCIFORM proved best method of butt-joining main bridge members.

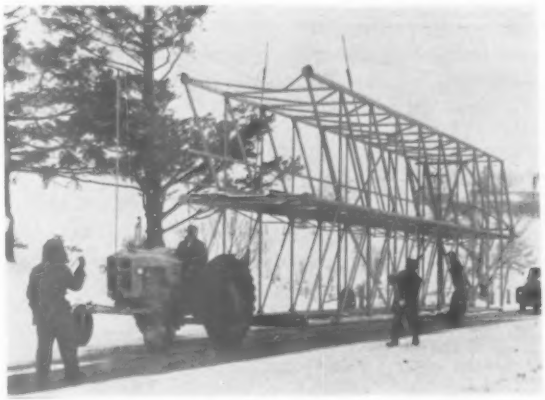
fabrication of the bridge in three 60-ft sections. Each section had flanged ends for bolting sections together.

All four corners of the bridge are identical in design and have self-aligning roller bearings fixed at one end of the bridge which roll on steel plates at the other end. Paint was used only where this steel touches aluminum. To prevent possible electrolytic corrosion, zinc chromate was applied to the aluminum structure.

Actual fabrication of the bridge was carried out in three steps.

First, diagonal and column members in the three horizontal planes were welded into triangles composed of two diagonals and one column, with a tent forming the joint at each point. Using the same jig, one column and a diagonal member were joined to form a vee. Here again, a tent was the joint at the apex, while another tent was welded to the other end of the diagonal member.

The second step was fabrication of main tubular



ON its way to installation site, this bridge section had to be brought through snow storm. Truss has low road clearance, and workers see that it does not contact trolley wires.

ALMOST in place, three bridge sections have been joined and are being swung to pier height by cranes on each side of Grand River. Total weight of bridge, which will support a gravel conveyor, is 9,000 lb.

members. This involved joining members to obtain the necessary 60-ft length, then welding flanges in place. Pairs of tubes were carefully leveled and joined with the prefabricated triangle sections to form a horizontal spar. In all, nine of the spar assemblies were prepared.

Up to this point, most of the work had been done in the shop, but spar sections had now to be moved outdoors.

Here they were lined-up carefully on V-blocks and leveled in both directions. Actual assembly of the truss began, and the third fabrication step was underway.

Prefabricated V's which were to become vertical members of the truss were placed on tubes, squared-up and held rigidly in place with steel strapping. The strapping eliminated tack welding and, at the same time, made it possible to align an entire side of the truss with some give or take possibilities before welding started

After all vertical members had been erected and welded, the center spar was lifted in place and welded to the apex of the V's Then the process was repeated, in which V's for the upper part of the bridge were placed and welded, and the top spar leveled on the V's and welded.

Finally, wind bracing and hand railings were welded and the catwalk was put in place. When this entire process was repeated twice, the three bridge sections were completed.

All Mig Welded

All welding was done by the Mig (metal inert-gas) process, using 0.25 and 0.30-in.-diameter 56S aluminum alloy wire. The welding unit was mounted on a special carrier, made from a truck chassis, which could be moved about the bridge sections as required. Since the Mig welding unit was to be moved about the yard, it was mounted on a swing boom with a cooling water recirculating unit serving as counter balance.

The circulating unit itself is an ingenious device which Carter built from a small car heater. It is used as a heat exchanger with a fan from a vacuum cleaner to supplement cooling. The water pump, driven by a ¼-hp motor, circulates coolant.

Another test of ingenuity in this bridge building project was provided in moving three sections of the structure from welding shop to job site. A pair of truck wheels was fitted to an adjustable drop axle with rubber-lined V-blocks to cradle main tubular members.

The axle was fitted just behind the section's center of gravity. A hitch was fabricated and bolted to the flanges, and a Minneapolis-Moline tractor with hydraulic tow bar (provided by Waterloo Mfg. Co., Ltd.) was then attached to the end of the bridge section by means of a unique hitch.

6-in. Clearance

With 9-in.-diameter flanges and a 16-ft center-to-center distance on pipe members, overall height of the truss was 16 ft 9 in. The adjustable axle was set to give 6-in. clearance between flange and road surface, so a total height of 17 ft 3 in. was involved.

Since part of the route followed a trolley bus line, extreme care was exercised in measuring wire height to see that truss members would pass under them without contact. This is where the powered tow bar on the tractor came in handy . . . it was possible to raise or lower the end of the truss to obtain additional clearance when required.

Upon leaving the highway, truss members were raised on wheels 6 in. higher since there were no entangling wires.

When the three units were finally brought together on the lower bank of the Grand River, they were set on timbers, aligned and bolted together. Cranes were placed at each side of the river, and their cables were attached to either end of the bridge.

The cranes lifted and pulled the bridge across the river, raised it above piers, then lowered it into place. Within two hours erection was completed and the North American continent had its first aluminum tubular bridge.

FRESH air, even in sub-zero weather, is a welcome commodity for this weldor, who has followed submerged-arc unit through long pipe section.

When only 3/5 of all pipeline welds need be done normally . . .

Double-jointing is an automatic cost-saver

WITH THE ADVENT of a welding method devised by H. C. Price Co., Bartlesville, Okla., double-jointing of pipe sections to cut manual field welds almost in half is now a reality.

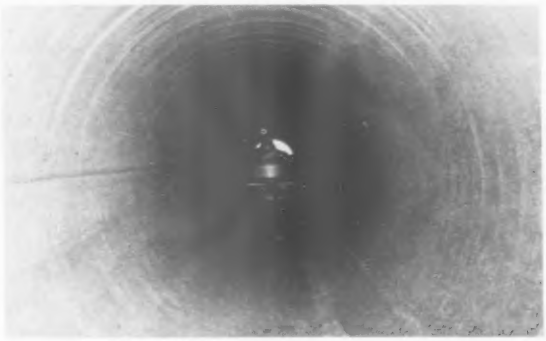
Both exterior and interior seams of a 99-mile section of Trans-Canada Pipe Lines, Ltd.'s system were welded by a "Price-O-Matic" unit *without preheat* in temperatures averaging 0 F.

The Price unit is an automatic submerged-arc welder closely resembling standard types. Behind the machine used for interior welds, however, is a couch on which lies the weldor who checks positioning, weld speed, flux disposal and weld quality.

The Price method eliminates need for stringer beads, hot pass, and root gap spacing. A shorter, thicker land is made on those pipes to be welded by this method.

When employed for the Trans-Canada job between Alberta and Montreal, the double-jointing method was

WELDORS are able to inspect interior seam welds on pipe by lying on this *couch* mounted behind welding head.



LIKE a bullet in a gun barrel, weldor and welding unit are propelled through pipe section.

used on days as cold as —44 F. Qualification tests were made on a day when temperatures did not rise above —24 F. Yet, an average output of 70 welds a day was successfully maintained in the yards of Price-Poole of Canada, Inc.

Pipe was supplied to the firm in 40-ft sections that were 34 in. in diameter and had a 3/8-in. wall thickness *(pipe was API 5LX-52 with a 72,000 psi tensile strength)*. Each section had a 30-deg bevel and a 1/16-in. land. This latter dimension was increased to 1/4 in. with an electric bevel grinder with dual disks.

Lineup of pipe sections is a simple matter. Edges are butted and internal lineup clamps are installed. Manual arc welding is used to place thin cast-iron straps for backup on areas of lineup clamps which contact the pipe.

Welding Speeds

Prior to lineup, pipe sections are placed on rubber-tired rollers which revolve pipe for welding. Exterior seams are welded at an average rate of 52 in. per minute (although a 70-ipm rate has been attained), and the interior bead is laid at a speed of 40 ipm. Total time for two outside passes is 7 minutes; inside welding is done in 3 minutes.

A 3/64-in. welding wire is used on all welds, and current is 300 to 600 amp at 32 to 35 volts. Power sources for welding are two 600-amp machines mounted in a trailer; a third welder is retained as a spare. Wire feed speed is governed by amperage.

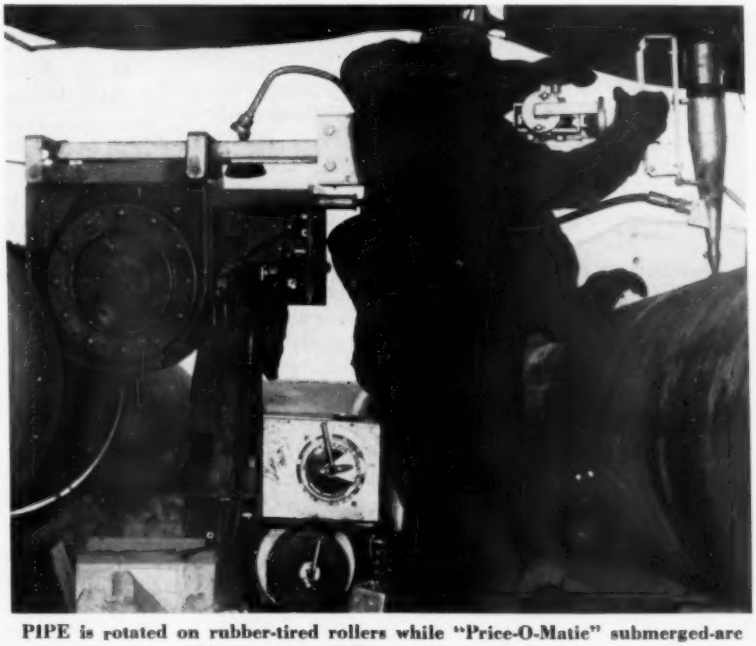
Price-Poole claims that, by eliminating root gap spacing, 80% of each weld is base metal; only 20% is weld metal. The outside joint groove when welding begins is only 3/16 in. wide; deep penetration of the submerged-arc process—plus the fact that both sides of the joint are welded—is responsible for the high degree of base metal fusion.

Tough and unconventional weld specimen tests seem to bear out the firm's contention. A horizontal side-bend test has been applied more than 30 times without a failure; specimens have been twisted up to eight times and have shown excellent ductility features, and X-rays indicate almost 100% weld quality. All tests exceeded requirements of the API—AGA code.

Cost of the "Price-O-Matic" method is reportedly far less than that of an all-field-welded job. Utilization of the more economical plant-welding setup, of course, is the biggest factor in cutting these costs.

Only three men are required for actual welding operations: two submerged-arc operators, and a manual arc weldor for tacking backup strips.

SUPPLIED to Price-Poole in 40-ft sections with 30-deg bevel and 1/16-in. land, 34-in.-diameter pipe is re-beveled to achieve 1/4-in. land. Electric unit with two abrasive disks is manually operated, but does job quickly.



PIPE is rotated on rubber-tired rollers while "Price-O-Matic" submerged-arc unit makes two weld passes in a 3/16-in. vee-groove. Only two operators are needed for unit (one to guide welding head), while another weldor tacks backup straps to interior lineup clamps. Exterior seams are welded at 52 ipm, interior seams at 40 ipm.

Arc welding defined

Happenstance plays no part in the design of arc welding electrodes. The seven types produced for mild steel applications, for instance, have individual qualities which create distinct welding characteristics. Just how you can best put these traits to work for you is shown by . . .

Testing electrodes for usability and efficiency

By Bela M. Ronay

ALL MATERIALS used to fill weld grooves are classified generally as filler metals. More specifically, they are divided into two major groups: filler materials for arc welding (*electrodes*), and materials deposited by oxyacetylene, carbon-arc or Tig (tungsten inert-gas) welding processes (*welding rods*).

In keeping with the main theme of this series—a definition of principal phases of arc welding—this article will discuss only electrodes, and particularly those used for welding mild steel.

The American Welding Society classifies electrodes on the basis of tensile strength obtained in the weld deposits they make, and on the character of their coating.

Classification is expressed in four digits following the letter "E"—which, of course, stands for *electrode*. The first two digits define nominal tensile strength of weld deposited from the electrode. Remaining digits identify character of the coating.

7 Classifications

Those coated electrodes used for mild steel welding are usually listed under seven different classification numbers: E6010, 6011, 6012, 6013, 6016, 6020 and 6024. Most electrode manufacturers produce more than one brand in each of these classes.

Core wire composition for electrodes in all seven classes varies only slightly. Where a difference occurs, it is in carbon content, which varies from 0.08 to 0.12% in all-position electrodes, and from 0.10 to 0.14% in electrodes designed only for downhand welding.

As simple as electrodes may seem when examined visually, each is actually the result of scientific investigation. To make properly fused, sound weld deposits, electrodes must satisfy several requirements.

In describing electrode performance, we often say that each electrode is a miniature arc furnace. This is a descriptive statement, but not very accurate.

From an arc furnace, metal is poured in a continuous stream. An electrode deposit, however, entails factors other than core-wire melting to produce the furnace charge. When welding, we intend to fuse metal melted by the arc with the mold (*i.e.*, the sides of a weld groove).

Heat, therefore, must be introduced into the mold at a rate sufficient to permit fusion between deposited metal and portions of the groove directly exposed to the arc.

The person with a knowledge of oxyacetylene flame-cutting operations knows how easy it is to burn steel with a heavy charge of oxygen. The air around us is approximately 20% oxygen, so it, too, will burn steel, though at a slower rate and not so completely as the concentrated oxygen issuing from a torch.

Scientists, engineers and technicians who helped design coated electrodes had this fact in mind, for the coating liberates a shielding gas in volumes sufficient to prevent weld metal from burning and being weakened. Presence of the gas is short-lived, but it remains long enough for weld metal to cool to a point at which it will no longer associate with constituents of the air.

The greater portion of the electrode coating, when melted in the arc, becomes liquid slag which covers the freshly-deposited weld metal and further shields it from air. (This slag also has other important functions.)

Electrode designers, by varying composition and volume of coating, can alter the mechanics of metal transfer through the arc. The seven electrode classifications listed above represent the most widely used forms of these variations.

The Oldest Type

Oldest of the coated electrodes, the E6010 is termed a cellulosic type. Its coating contains two major ingredients: pure sand and wood flour. The latter amounts to 22% by weight.

The combination of these ingredients—their proportion, and thickness and density of the coating—are so arranged that metal deposition takes place in a definite pattern.

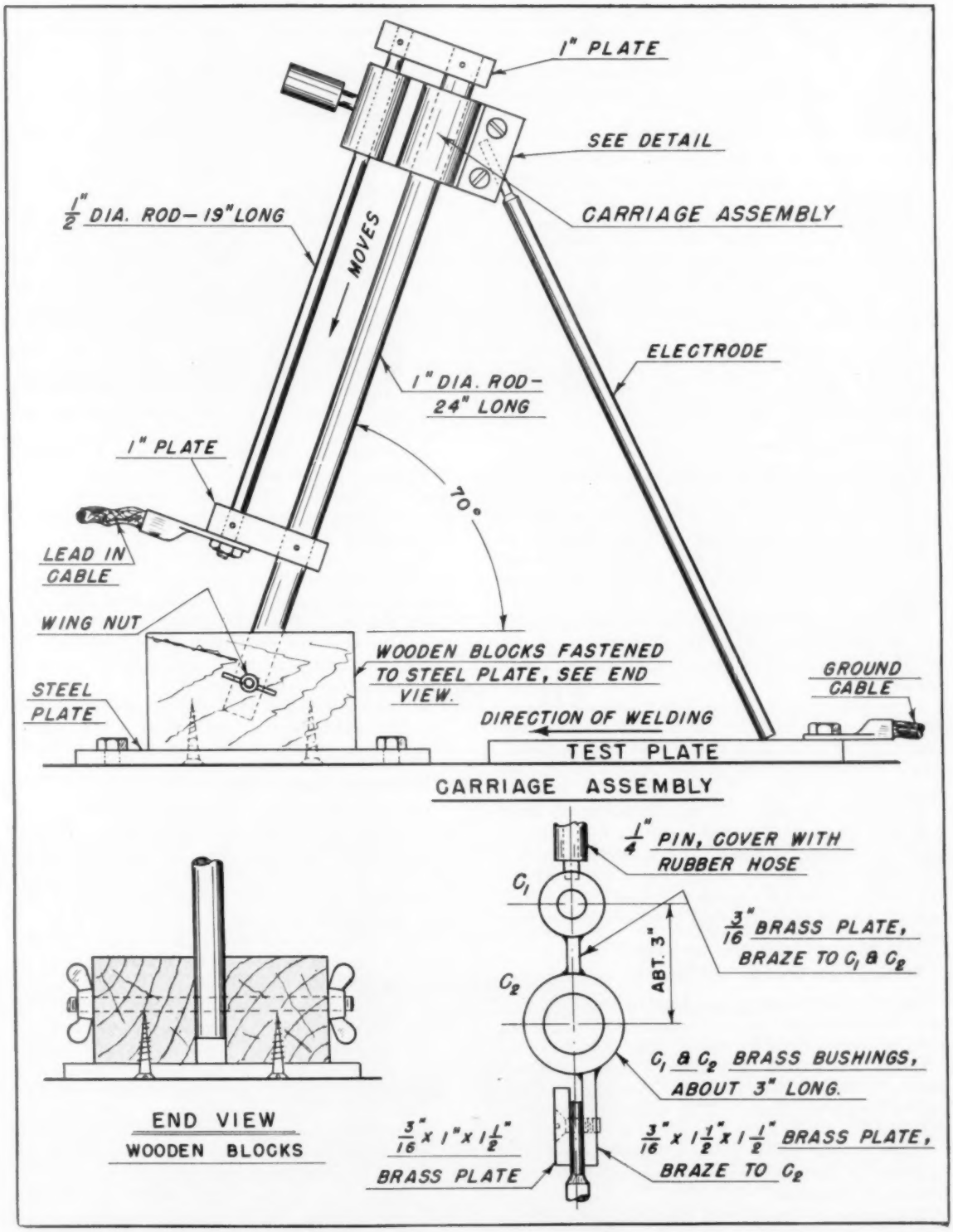
Almost immediately after the arc is struck, the tip of the core wire melts and forms a globule. This globule is retained within the miniature crucible formed by the non-combustible portion of the coating, the melting point of which is higher than that of core wire.

The crucible acts as a shallow mortar—gas formed within it expels the globule through the arc, where it breaks into tiny pellets. This cycle of molten weld metal repeated 6 to 12 times a second, in fairly regular cadence, by the E6010 electrode type.

Cycle regulation is directly related to core wire composition and coating design. Scientific instruments are used by test laboratories to determine cadence regularity. This test often reveals coating and core wire design deficiencies which can be corrected to permit better fusion and greater volumes of shielding gas for weld metal protection.

Metal transfer from E6020 and 6024 electrode types differ considerably from that which characterizes an E6010 type. The former electrodes are intended only for use in flat and horizontal positions.

By changing coating composition (*i.e.*, reducing the percentage of combustible ingredients and substituting



THIS simple apparatus permits quick tests of electrode deposition qualities, and indicates best arc length and current values. End plates can be ¾-in. steel or brass plates, 2 in. wide and 4 in. long, drilled for bolting to work table and for insertion of screws holding wooden blocks. Bushings of carriage assembly are drilled after center plate and bottom lugs are brazed. Holes for guide rods must be parallel for smooth action. Start with 70-deg angle between carriage and test plate when testing horizontal deposition; change to 20-deg angle for vertical welds. Entire device is grounded; operator should wear safety gloves and touch only rubber-covered pin in top bushing of the carriage.

iron oxide or iron oxide/iron powder, respectively) in the E6020 and 6024 types, designers changed the mechanics of metal transfer for these types. There is, for instance, no cadence; the crucible formed at the electrode tip is deep, holding a larger volume of hotter and more liquid weld metal.

This metal is transferred through the arc in a continuous stream of microscopic—and sub-microscopic—particles. The resulting deposit is flat and finely rippled.

Because the coating on E6020-24 types is heavier than that on the E6010, more electrical power is required for their application. On the credit side, however, they deposit more weld metal per hour than an E6010. The 6024, in turn, outstrips the 6020 in deposition by 25% because iron powder in its coating is transformed into weld metal by the arc.

While the E6010 electrode is suitable for use only with d-c reverse polarity, the E6020-24 types can be used with either a-c or d-c. When operating on d-c, straight polarity is best, particularly in fillet welding.

All-Position Types

The E6011 electrode, through modification of the non-consumable portion of its coating, is an a-c counterpart of the 6010. Metal transfer is a spray type, and the electrode may be used in all positions. However, absence of cadence in metal transfer demands both skill and close attention. The E6011 is used with reverse polarity.

Designed for use with a-c, or with d-c straight polarity, the E6012 and 6013 also are all-position types. The 6012 was developed primarily for applications on sheet metals.

Lime-coated E6015 and 6016 electrodes are intended for use on certain low-alloy steels which have not been preheated, or have been only moderately preheated. Power for 6015's must be d-c, but either a-c or d-c can be used with the 6016.

It is evident in these brief descriptions of the seven mild-steel electrodes that their selection for a specific application should be based on: (*a*) available welding equipment—*i. e.*, whether mostly a-c or d-c, or mixed; (*b*) positions in which joints to be welded can be placed, and (*c*) type of material: sheet metal or heavier plates and shapes.

Testing New Brands

Electrode manufacturing is a highly-competitive business. Because of this, users of established brands must often test claims made for new brands.

Except where code specifications apply, the test usually consists of trial use in the shop and a tabulation of weldor's comments. This method is somewhat unreliable . . . it is subject to personal whims.

However, tests which produce reliable information on reliability and usability *can* be made without intricate laboratory equipment.

The apparatus pictured with this article will reliably inform the electrode user on both the usability (or ease of operation) of a new brand, and on its efficiency—in terms of comparative weld metal deposition by old and new brands.

Since specifications give no definite requirements, a usability test is generally a critical one. In the hands of a skilled weldor, almost any electrode will yield weld deposits of acceptable appearance. Those electrodes, however, which must be constantly manipulated—or which must be discarded as 3 or 4-in. stubs—represent an undesirable production expense.

Tests to discover electrodes which will be usable, efficient and economical in the hands of the average weldor should not require manipulation by a skilled weldor.

Test Apparatus

A weldor need only see that constant arc length is maintained when using the apparatus in Fig. 1 to simulate manual welding in all positions. The device indicates whether an electrode can be deposited over its full length without requiring manipulative skill, and whether the weld deposit is of constant contour from start to finish.

Optimum arc length and current values can also be obtained in tests with this device. By timing electrode deposition accurately, the best current setting can be duplicated on welding machines other than that used for the test.

Guide rods and an electrode carriage are principal components of this testing apparatus, and guide-rod angle is adjustable. At the angle shown in the sketch, the bead deposited is about 5 in. long (bead length can be varied by adjusting guide-rod angle).

The carriage (electrode holder) is guided manually by the rubber-insulated pin screwed into the upper bushing of the carriage. When depositing weld metal in the flat, the carriage slides downward, when deposition is vertical, the carriage is pushed upward. The operator has only to guide the carriage gently and maintain constant arc length.

A sound observation for usability tests is that those electrodes which require "prompting" will produce a lumpy deposit or will "freeze" when operated manually.

Necessary Equipment

The electrode efficiency test should be conducted with the optimum arc length and current values uncovered in the usability test. An efficiency determination will require the use of a scale which clearly indicates ounces, a few pieces of scrap plate, and a 1-lb sample of each electrode brand to be tested.

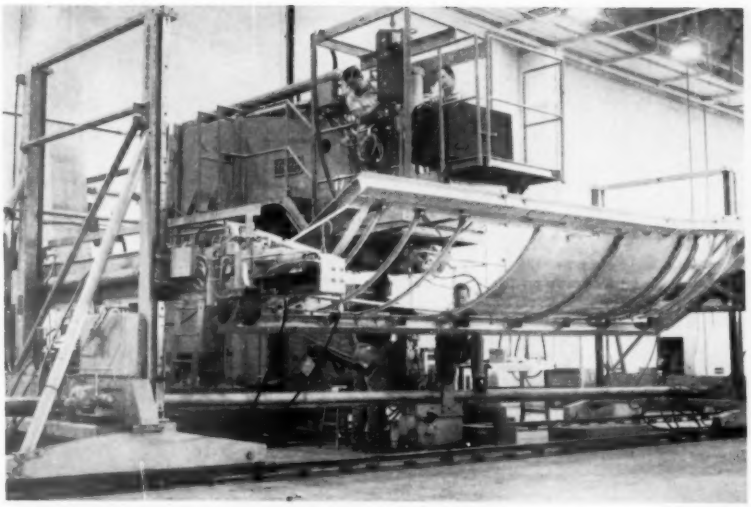
Weigh accurately and record the weight of the plate on which the first sample will be deposited. Stencil the plate for identification.

Take a 1-lb sample of the first electrode to be tested, and deposit this sample at current values determined in the usability test. Save the stubs from this electrode brand. When the test plate has been cleaned of slag and spatter, weigh it. All stubs should then be weighed separatedly.

Repeat this procedure for all other electrode brands to be tested. When the weight of test plates have been subtracted from the weights obtained after deposition (and when stub loss has been considered), the user will know what he can expect when using these electrodes in production.

Weldors' comments may be interesting . . . amusing . . . even highly informative. But they will always be influenced by personal prejudices in favor of this or that brand.

The results of this accurate and impersonal test will speak for themselves.



COMPLICATED positioner moves curved skin section into throat of huge spot welder, first of a bank of nine to be installed.

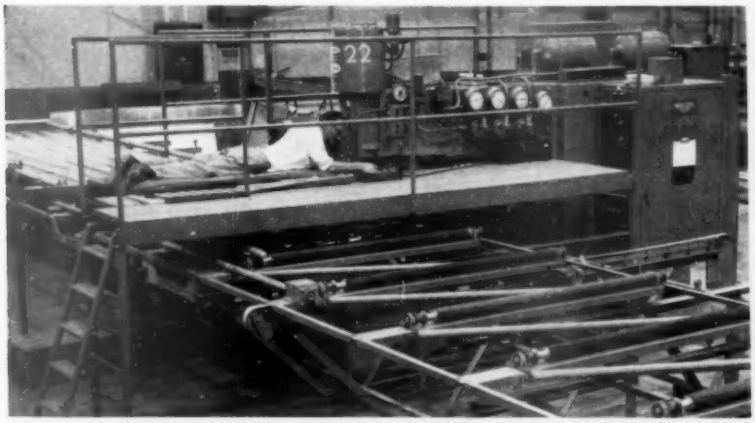
Ryan Aeronautical Co. uses . . .

Giant spot welders for giant aircraft

SPOT WELDING MACHINES that include the largest of their type ever built . . . and positioning tables that dwarf the welders—this is the gargantuan situation which exists on assembly lines at Ryan Aeronautical Co., San Diego, Calif.

Under contract from Boeing Aircraft Co., Ryan is welding double-contoured aluminum panels for aft fuselage sections. These sections are destined for installation on Boeing "KC-135" jet tanker-transports and the Boeing "707" commercial jet liners.

Urgent timetables have been set up by the Air Force for a large number of KC-135's, and 134 orders have been received from airlines throughout the world for 707's. These delivery dates are being met, thanks to pushbutton features of the welding installation which permits automatic parts feeding.



OPERATOR lies above positioning table as single-contour skins are fed into 70-in. throat of spot welding unit. TV is also used for electrode inspection.

Change in Plans

The double fuselage sections total 60 ft in length—making them the largest structures ever subcontracted in the aircraft industry. Their present method of fabrication, however, was not considered when Boeing first announced its plans.

Specifying spot welding rather than riveting to obtain cleaner, smoother surfaces with less drag and weight, Boeing's contract called only for the joining of single-contour skins which are easier to position for welding. But when Ryan was awarded this contract, Boeing requested the development of a welding technique that would permit spot welding of double-contour skin assemblies.

Delving into the welding metallurgy and fixturing problems posed by this unexpected change in plans, Ryan developed a handling device which used jackscrews, plus a heavy dose of manual positioning.

Attached to the welding frame to position it, four jackscrews were mounted on overhead monorails. Since the monorails were not powered, the frame had to be pushed by hand to each welding position.

This crude stopgap had to be kept in operation long enough to turn out fuselage units while a better and more permanent production set-up was being installed. Working with Ryan in this long-range installation was General Riveters, Inc., Buffalo, N. Y.

Turn-About

Although electrically-operated positioners for riveting had been General Riveters' forte for years, the firm had now to make a reversal and design electronically-operated positioning tables for welders. Result of the Ryan-General Riveters collaboration was a system of "sensor leveling."

Intricate configuration of KC-135 skins did not permit use of a four-directional positioning table which General had been fabricating for riveting wing structures. Only a mechanism highly sensitive to electronic commands could guide bulky panels

LEFT: Worker checks interior welds on half-lobe of KC-135 aft fuselage section, which was fabricated by spot welders like giant pictured below. This machine has a throat depth of 73 in. and weighs over 29 tons.

through the throats of welding machines. "Sensor leveling" was the answer.

The how's and why's of this unique method of electronic positioning is best seen in its relationship to the actual production sequence. Here's how Ryan does it.

2,000-kw Transformer

Three mammoth spot welders—the first segment of a battery of nine—have been installed on the production line. A 2,000-kw transformer supplies current to machines now in use, and is capable of powering all nine when installation is completed.

The throat of each welder measures 73 x 54 in.; the machines are over 13½ ft in height, and each weighs more than 58,000 lb. A three-phase, unipolar, 250-kva transformer supplies 100,000 amp of welding current to each unit. (These 25,000-lb transformers had to be developed with new techniques.)

Mounted on an electrode in each machine is a sensor-head—a box equipped with four nylon sensor knobs. Protruding from the box, the knobs contact aluminum sheet being fed through the welder's throat and raise it ⅛ in. above electrodes to eliminate scratching. When the welding sequence is started, sheets are lowered to contact the lower electrode.

Welding Controls

In its effect upon screwjacks on the positioning carriage, the sensing unit also controls horizontal and vertical motion of parts, and creates a rolling motion which gets parts into the machine throat at a proper angle.

Ryan must use manual controls only for locating the position of the first spot weld, and for loading and unloading operations. There are few other aspects of the job which require individual operator movements. For almost all welding operations, a tape-command unit positions parts in all directions. This control device also provides automatic interlock between positioner and welder.

As part of the tape-command unit, an increment spacer aids in the attainment of equally spaced welds. It also cuts tapes for tape command operations.

A further aid to positioning is provided by a tracing head mounted next to upper electrodes. In meeting the edges of doublers and stiffeners, it provides edge-distance spacing that never varies.

Single Contour Skins

A manually-operated positioner is used by Ryan for single-contour skins. Spot welders with 60-in.-deep throats handle straight-line spot welding on parts positioned on two of these flat tables.

Two additional panel tables for single-contour skins have been installed by General Riveters. Using a combination of electrical and hydraulic controls, these tables index longitudinally and transversely. One table holds parts for a welder with a 70-in. throat depth—exceptional for a machine of this type.

Single-contour positioning tables incorporate a counting system in which the count is a predetermined number of 1/10-in. increments. Spaces between spot welds are multiples of these increments.

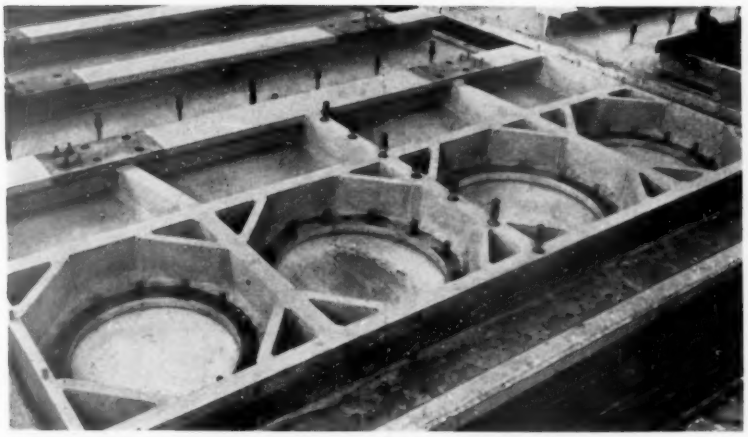
A photoelectric cell counts light spaces. When a predetermined number of light spaces has passed through the counting relay, movement is stopped and the welder fires automatically. A conventional switching system is used for longitudinal and transverse movement.

On flat positioner tables, a TV camera beneath the table aids the operator in maintaining weld quality (*see* "TV spots build-up on resistance electrodes," WELDING ENGINEER, *Jan., 1957, p. 24*).

Cleaning Is Critical

Keeping massive skin sections clean is a critical problem at Ryan. Through the use of white gloves, covers for parts awaiting welding, and date-stamping, however, technicians have achieved a remarkable degree of cleanliness. All parts are etched, and must be welded within 24 hours.

A staggering number of welds—approximately 77,000—are needed to complete aft fuselage sections for the jet tanker-transports. In view of this fact, electronically-fed parts and automatic spot welding operations are the best possible methods to achieve volume production under a tight time schedule.



FLEXIBLE plate of wind tunnel showing studs welded to stiffeners for control gear. Note manometer stud-welded to plate.

British weld studs for plane test sites

By William A. Heath

GROWING APPRECIATION of the practical advantages of stud welding is leading to its increased use by British firms engaged in construction work at aircraft research plants.

An important contract just completed is the building of a new closed-circuit supersonic wind tunnel at the Royal Aircraft Establishment, Bedford. Costain-John Brown, Ltd., contractors for the job, welded over 2,000 studs using Compton Parkinson Co. equipment.

Subsonic flow in the wind tunnel can be controlled by changing compressor speed. Supersonic flow, on the other hand, can only be developed and regulated by introducing a nozzle into air flow at the working section.

Shaping Nozzles

Required nozzle shape is obtained by bending inch-thick flexible steel plates, 63 ft long by 8 ft wide. These plates form the roof and floor of the section, whose fixed side walls are 8 ft apart. Distances between roof and floor can be varied from 2 ft 4 in. to 8 ft so that different nozzle shapes may be made.

Local deflection of the plates is accomplished by using jackscrews, two of which are attached to each of the 30 T-section stiffeners transversely placed at approximate 2-ft intervals along the length of the plates.

To attach the jacks' electrical control gear, four ⅜-in.-diameter fully-threaded studs are welded to stiffener flanges next to each jacking position. The jacking reaction load is taken by a series of fabricated portal structure groups.

Under operational conditions, as there is differential air pressure across the flexible plate, a seal is provided between moving edges of the plate and the fixed side walls. Seals are retained by welding ⅜-in. studs to the back of the flexible plate adjacent to the edges.

Advantages of Welding

Stud welding shows great advantages here over drilling and tapping, which gives troublesome stress during flexing. Seal failure would involve considerable expense and lost time.

Another use of stud welding on this job is the attachment of ½-in.-OD manometer tubes to measure air pressure at points in the tunnel. These vary in length from 3 to 20 in., manufactured as ½-in. female pins, drilled ⅜-in. in diameter by 3-in. deep at the non-welding end.

After manometers were welded into place and drilling was completed through the rest of the pins and flexible plate, the tubes were pressure tested. Longest tubes are in the wind tunnel supersonic diffuser section where the airstream is slowed to less than the speed of sound.

The flow is changed by a variable cross-section obtained when the position of the hinged side walls is adjusted with jackscrews.

Forming Walls

Each hinged wall is a box consisting of two plates over 12 in. apart. Stud welded through a 1-in.-diameter hole were 20-in. pins to hold the inner plate to the outer. Exceptional accuracy was needed since only 3 in. of each pin was pre-drilled and it was essential to produce a concentric tube able to withstand high-pressure tests.

"Blind" welding was carried out satisfactorily by a special chuck attachment which insured welding at a proper angle. Moving parts in the supersonic diffuser section are sealed against differential air pressure by welding ⅜-in. studs to hold seal-retaining plates to the edge of movable plates.

Another firm which uses stud welding is Bristol Aero Engines, Ltd., which can test 200 "Proteus" engines a year in a new turbo-prop proving house. Two-thirds of test space is devoted to intake and exhaust silencers, where airstreams are broken up and quieted by curved baffle screens.

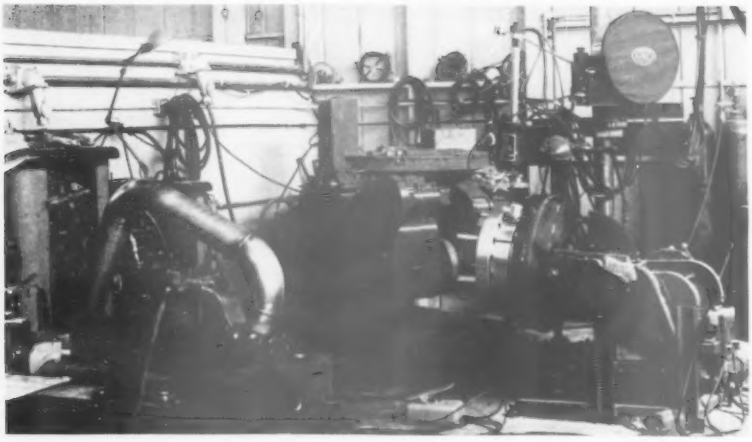
Airstreams are forced into desired paths by the screens, which are staggered for maximum silencing.

Studs Used

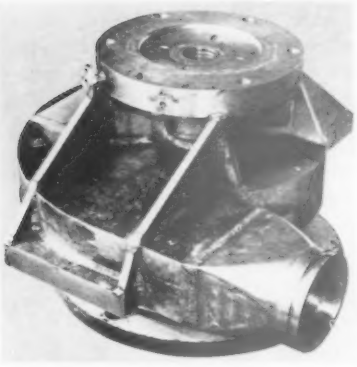
Stud welding was used to fasten baffle screens to steel plates in the concrete floor and ceiling of the test tunnel.

In another of the Bristol firm's test houses, where "Olympus" engines are tested, stud welding was used to attach insulation panels of 4-in. thick mineral wool between corrugated aluminum reflector sheets to the main concrete structure. Insulating slabs were placed over groups of two studs which were surrounded by tubular distance pieces.

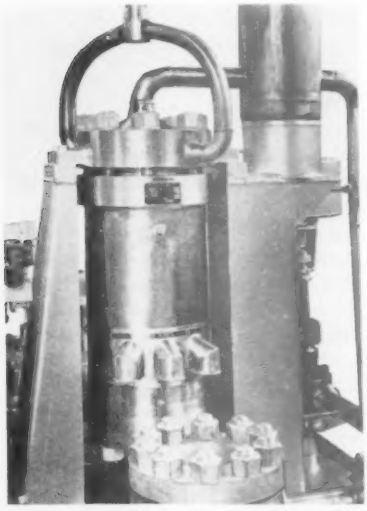
A second steel plate acted as a washer. Held down by nuts, it keeps insulation in position. This was found to be a quick and accurate fixing method as well as a money saver.



NUCLEAR welding section at Byron Jackson Div. of Borg-Warner is designed to achieve maximum weld quality under stringent atomic welding specifications. Automatic Mig welding head is mounted on movable platform to service three different types of positioned welding.



LIQUID sodium-potassium pump was fabricated from forgings of type 347 stainless for service at 1,100 F max. Manual metal-arc welding was used without backup for all main pressure-containing weldments.



CLOSE-UP of pipe weldments and construction details on high-pressure, high-temperature water loop. Argon was used for weld backup.

IN THE ATOMIC INDUSTRY

Welding gets credit for nuclear progress

By F. R. Drahos, *Chief Metallurgist*
Byron Jackson Div.
Borg-Warner Corp.
Los Angeles, Calif.

SINCE December, 1942, when man achieved the first self-sustaining nuclear chain reaction, great strides have been made in expanding the potential of controlled nuclear energy release.

The atomic energy field has presented all industries with technical and engineering challenges. Liquid metals at elevated temperature, radioactive solutions and high-purity demineralized waters pose critical manufacturing and design concepts.

New Welding Concepts

The science and art of welding have provided the atomic industry with a tool of great value. Production of some equipment without welding would be extremely difficult—if not impossible.

New concepts of welding techniques, processes and equipment have had to be established to comply with demands of the atomic energy field. Centrifugal pumps for nuclear service, for example, must have one or all of these design requirements:

(*1*) Radiographic quality castings.

(*2*) High degree of internal surface finish—*i.e.*, freedom from pinholes, sub-surface pockets or any roughness that could trap radioactive particles.

(*3*) Only Tig or Mig welded parts contacting process fluid.

(*4*) Weldments with full penetration; strength and pressure standards of X-ray quality.

(*5*) Ultrasonic-quality plate, forgings and bar stock.

(*6*) Helium mass spectrometer inspection for "zero leakage" before and after hydrostatic testing.

(*7*) All parts cleaned by acids, detergents, distilled water, etc., to meet exacting cleanliness standards.

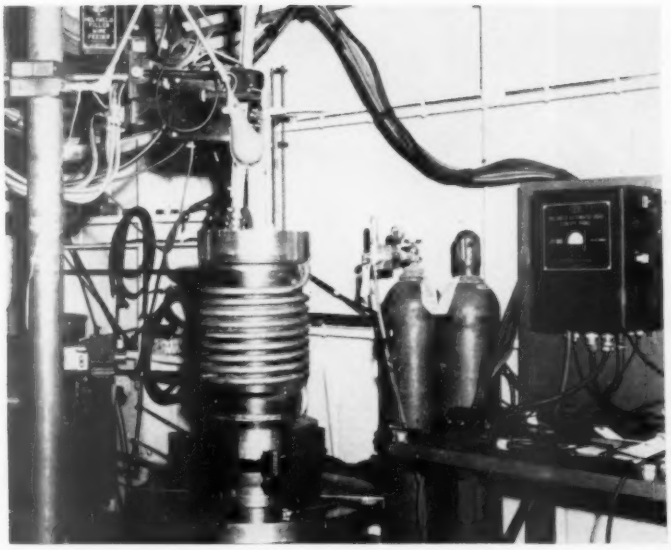
(*8*) All pump openings sealed and pressurized with inert gas, or sealed in evacuated containers for shipment to job site.

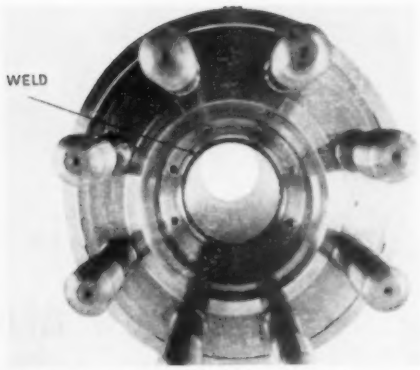
Weldor Qualification

In welding for nuclear service, all weldors must successfully pass nationally recognized qualification tests. They must also be capable of making welds of X-ray quality. Fabricators, too, must be fully qualified in welding procedure.

Chemistry and weldability of base

This article is based on a paper presented by the author at the Tenth Western Metal Congress in Los Angeles.





LEFT: Typical Tig welding set-up for canned motor pump components. Welded cylindrical stator can prevents pumped liquid from wetting stator windings.

ABOVE: completed can weldment is hydrostatically tested at 3,750 psig; mass spectrometer test follows.

metals and electrodes must be known, and all weldors must magnetically check each electrode before using it.

This same thoroughness is also applied to parts cleaning. All joints (and adjoining areas to be welded) are cleaned, first, with a stainless steel wire brush and, second, by washing with new or re-distilled acetone. The solvent wash is followed by a clean water rinse and drying with lint-free cloths.

Careful Fit-Up

All stainless steel joints have to be prepared for welding by machining. Flame- or arc-cutting methods are not allowed.

Weld joints for nuclear service must be carefully fitted, and fabricators stress the fact that extra fit-up time pays dividends in top weld quality. The use of non-removable backup rings is never permitted.

Welding is never performed on nuclear components when base metal temperature is less than O F, or over 300 F. Preferred base metal position for manual welding is the flat position. Submerged-arc welds, naturally, must also be made in a horizontal position.

When nuclear service welds are made with the metal-arc or Mig (metal inert-gas) processes, design requirements specify d-c reverse polarity. Tig (tungsten inert-gas) welds are made with d-c straight polarity. Only thoriated tungsten electrodes are used with the latter process.

Weld Inspection

Tig welds are always used for the first two passes, and the underside of a joint receives an argon or helium backup. Delivery pressure of this purging gas is specified at between 3 and 5 cfh.

All accessible weld surfaces must be inspected by the liquid penetrant method after the root pass, after midsection is reached on heavy walls, and upon completion. Weldments must be ground prior to this penetrant inspection, and they must be cleaned after inspection before welding resumes.

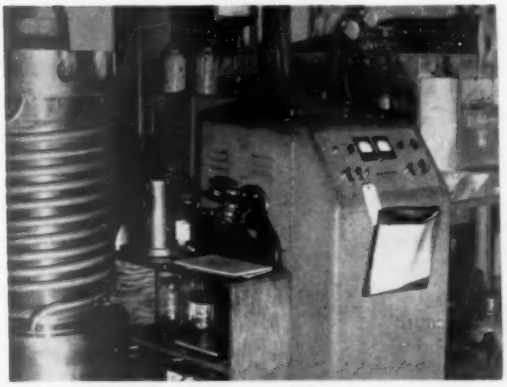
Radiographic inspection is also required on nuclear welds, and it is conducted at the three stages listed above for liquid penetrant inspection. With a few exceptions, radiographic requirements conform to Section 8 of the ASME Code (*par. UW-51*). The exceptions concern tungsten or tungsten oxide inclusions in the $\frac{1}{8}$-in. deposit on the process-solution side: scattered or in-line porosity, or inclusions, all of which must be rejected.

A Change in Standards?

Although the base fabrication standard most often referred to is the ASME Unfired Pressure Vessel Code (Section 8), the atomic industry must amplify this Code to cover its requirements. In view of this fact, it seems that establishment of an atomic welding and inspection standard should be considered.

This would incorporate welding requirements of this infant industry, from a multitude of individual specifications, into one atomic standard.

The critical welding requirements of the atomic energy field *can* be complied with. Welding is one of the industries upon which the U.S. and the world will become increasingly dependent for future Atomic Age developments.



HELIUM leak inspection station. Maximum tolerated leak rate is 8 x 10-6 cc/sec, assuring zero-leakage in radioactive systems.

Dollars in your pocket

Cylinder care is easier than cylinder abuse—don't neglect yours!

OXYGEN and acetylene cylinders *look* and *are* rugged. But you can save needless repair bills and replacement units by treating them as you would a blonde: cautiously and carefully.

One of the most frequent causes of damage to a container in use, according to Linde Co., is arc-burning. An arc—or any electrical current—near a grounded cylinder may send an explosive spark through the container, ruining or seriously damaging regulators.

To avoid unnecessary injury from arc-burning, follow these simple rules: do not allow your cylinder to become grounded, insulate it with wood or rubber. Keep all work tables or welding fixtures safely away from contact with oxygen or acetylene storage units. If this isn't practical, install a guard between tank and any work in progress.

From the Top Down

Before moving an oxygen cylinder make sure the valve protection cap is on straight, and is tightened. Valve caps are sensitive and easily damaged. If you must lift a container from the floor, be positive the cap is firmly fastened; then lift the cylinder to a standing position.

When a cylinder valve cannot be opened by hand, *don't force it*. After you have finished a job, make a definite point of closing the valve. A little attention to what seem to be "small details" may save you "big money."

If you receive a defective cylinder, beware of home-repair work. Better tag it so no one else tries—unsuccessfully— to put the cylinder into operation. Notify your supplier immediately and he will replace the flawed container with one which is in proper working condition.

Storing and Transporting

Moving a cylinder for any distance should be done on a truck equipped with a chain to prevent fall-over. And when you transport the container to the truck, roll it on the bottom edge. Dragging or sliding a cylinder is not only hard work—it is dangerous.

To move a tank a short distance or vertically, use a cradle, boat, or a platform. Don't use the risky sling or the highly dangerous electromagnet.

An oxygen or acetylene cylinder is heavy—very heavy—and should be rock-solid to avoid the possibility of its falling on you or someone else, or even causing severe damage to itself when no one happens to be near. Chain it to a stout anchor of some kind. The more secure the cylinder is, the more secure you can feel. Avoid using the tank as a support or as a roller; remember, the tank was meant for storage, not as a sure-fire protective device.

Finally, don't leave oily or grease-soaked rags scattered about near a tank, for while oxygen does not burn, it does *aid* burning by supplying one of the needed ingredients of fire: air.

A Hint

If you can afford to damage or ruin oxygen or acetylene cylinders, pay no attention to this article. You don't need it. But if you are determined to conserve your equipment and supplies, keep this article in mind. It will save you money.

DON'T try to force cylinder caps. Be sure cap is straight.

KEEP cylinders chained upright to prevent fall-over.

ALWAYS roll container on bottom edge. Don't skid on side.

Cracked cast iron block ...repaired the same day ...with Ni-Rod "55" Electrode

Replacement...or repair? That was the dilemma facing one Ohio contractor when the 150-pound pulley block shown above cracked in the middle of a job.

Replacement was expensive. And it might take days – perhaps weeks.

The contractor had heard of successful welds in cast iron with Ni-Rod* "55"* electrode and decided to go ahead with the repair.

Using Ni-Rod "55" electrode, weldors at the Alsco Welding Company in Columbus got a strong sound weld . . . had the block in operation the same day. As an extra precaution, they preheated to an estimated 250 degrees. (With Ni-Rod "55" electrode this is generally unnecessary.) The weld was approximately 14 inches long, and took only 1-1/2 pounds of 5/32-inch Ni-Rod "55" electrode.

You'll like the simplicity Ni-Rod "55" electrode brings to cast iron welding. Ni-Rod "55" electrode is operable in all positions . . . gives a stable arc and metal deposition is good. Slag is easy to remove and the welds are readily machinable.

"A Handy Guide to Welding Cast Irons" gives useful technical data, case histories and tips on welding methods. If you fabricate, repair or salvage cast iron parts, keep a copy handy. Why not write for one today?

*Registered trademark

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK **Welding Products**

Electrodes • Wires • Fluxes

DAILY EXP

★ ★ ★ ★

Man with gun thwarts production holdup!

. . . Barber-Greene, manufacturer of asphalt batch plants, uses C-OMANUAL* to cut welding production costs 61% on large gear box

Aurora, Ill. — In a daring daylight operation, Barber-Greene took a big step toward putting their welding operation on a high-speed, semi-automatic production basis.

The weapon employed was A. O. Smith's C-OMANUAL (CO_2) hand gun process. Preliminary reports indicate current savings on this phase of production amount to at least $60.30, per gear box, or 10.22 hours.

Outstanding weld quality

Using A. O. Smith's specially developed wire (CO-86) — Barber-Greene has discovered weld quality far surpasses that previously possible. This gain is due to a combination of factors.

First, because the operation involves a unique high-density principle, there is exceptional penetration and deposit uniformity. Also, tests show the welds to have excellent strength and ductility characteristics.

In addition to C-OMANUAL'S inherent high rate of deposit, the operator works with a visible arc. His eyes tell him whether he's in the groove. Spotting of the nozzle is simplified.

Then, too, he seldom has to stop to fiddle with settings. The C-OMANUAL control console adjusts arc length, compensates for distance variations. False starts or reworking the weld are practically eliminated. And when the job's done — there's no flux to clean, no need for chipping or scraping.

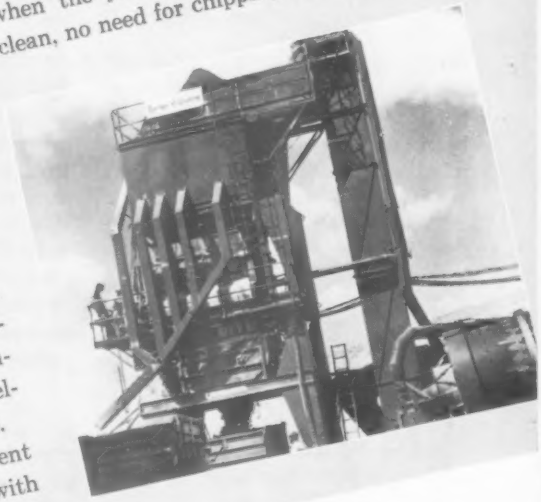
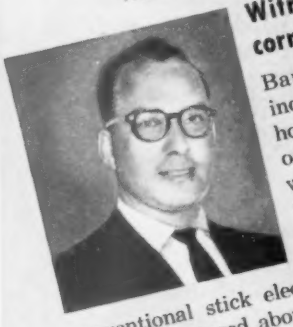


Photo shows C-OMANUAL operator at work. Note the compactness and obviously easy-to-handle and move C-OMANUAL package. Hand gun, portable control console and special

A. O. Smith d-c power source consume a minimum of space. Changing wire reels involves merely flipping open side of console, taking out exhausted reel and substituting a new reel.



Witnesses corroborate story . . .

Barber-Greene officials, including Robert McMahon, the welding engineer on the job, report that with C-OMANUAL, work is proceeding at a much faster rate than previously possible with conventional stick electrodes. Welding time for gear box pictured above, was reduced drastically — from 18 hours to 6 hours. The "man from A. O. Smith" (shown) is Al Vandegriff who worked with Barber-Greene on the installation. More than a salesman, he's a welding specialist — ready and eager to help with any welding problem.

C-OMANUAL Package

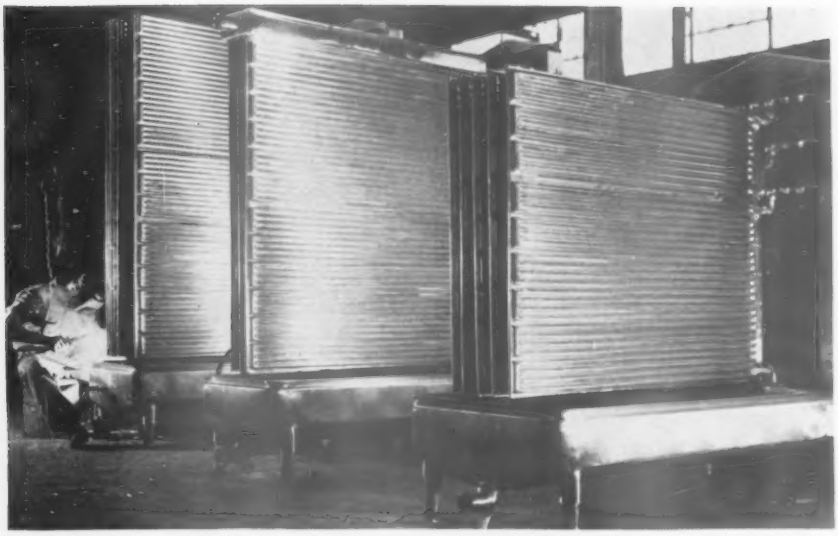
consists of a feather-weight hand gun . . . easily movable remote control console . . . and the power source — a special A. O. Smith d-c rectifier. Armed with CO-86 wire, this package delivers the best in high-speed, semi-automatic welding.

Through research A.O. Smith *. . . a better way*

If you'd like to know how A. O. Smith C-OMANUAL can help you guard against production holdups — write direct.

*Patents Pending

A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
International Division: Milwaukee 1, Wisconsin, U. S. A.



STAINLESS steel arc welding electrodes are used to join these stainless cooling coils at A. O. Smith Corp., Milwaukee.

Filler metals for joining

By Orville T. Barnett*

WELDING FABRICATORS often experience the disquieting feeling that there are more varieties of stainless steel filler metals than Carter has pills.

To further complicate an already complex choice, stainless filler may be purchased in both rod and coated electrode forms, and it may be applied suitably by the gas, manual arc, submerged-arc and inert-gas-shielded arc welding processes.

Areas of application do not provide a limiting factor, either, for stainless steels are specified for corrosion resistance, for elevated temperature service, and for wear resistance.

Most common stainless steel fabricating problems can be solved by a thorough understanding of the 300, 400 and 500 series of filler metals described by two AWS-ASTM specifications. In following these specs, you can eliminate such special problems as the up-and-coming 200 series, the precipitation-hardening varieties (*e. g.*, 17-7PH) and the excellent—though unusual—corrosion resisting and high-temperature service analyses.

An experienced welding engineer generally establishes the procedure for these less common materials. A good rule to follow in welding stainless is to seek help if the least doubt concerning procedure exists.

Common Terminology

Table I lists simplified chemical analyses for filler metals which we have thus far termed "stainless steel." This is common practice, but specifications call these fillers "corrosion-resisting" types—a more precise terminology. Everyone will agree that type 502, with just 5% chromium, is not *stainless*.

One specification in force today covers bare rods for oxyacetylene, Tig or Mig welding, and is titled *Tentative specifications for corrosion-resisting chromium and chromium-nickel-steel welding rods and bare electrodes* (ASTM designation A 371-53T, AWS designation A 5.9-53T).

The other existing specification covers coated electrodes for manual metal arc welding, and is titled *Tentative specifications for corrosion-resisting chromium and chromium-nickel-steel covered welding electrodes* (ASTM designation A 298-55T, AWS designation A 5.4-55T).

A simultaneous study of both specifications will result in a clear understanding of stainless steel filler metals. (Common, rather than technical, terminology with be used throughout this article.)

Prefixes *E* and *ER* refer respectively, to metal arc electrodes and to electrodes or rods. The *E* designation for manual coated electrodes, and the *R* for gas welding rods, are well-known terms. But in the last decade, inert-gas-shielded arc welding has forced a change in prefixes.

R still means bare rods, but it now designates rods used for Tig as well as oxyacetylene welding. *ER* denotes electrodes and rods used for gas, Tig, Mig and submerged-arc welding.

Simplification Needed

Suffixes *ELC* and *L* signify an extra-low-carbon analysis designed to avoid the problem of carbide precipitation. In future revisions, this double designation may be simplified by adopting the *L* suffix in both specifications.

Other suffixes, *Cb* for columbium and *Mo* for molybdenum, provide for gaps in the AISI numbers. If, for example, there were no AISI type 347, such an electrode would have to be listed as E308 Cb. All numbers used in Table I are AISI numbers.

The 308 filler metals (E308, ER308, E308 ELC, ER308 L) have the common 19-9 analysis (it is customary to give chromium per cent before nickel per cent). They may be used

*Assistant manager, Metals Research Dept., Armour Research Foundation of Illinois Institute of Technology, Chicago.

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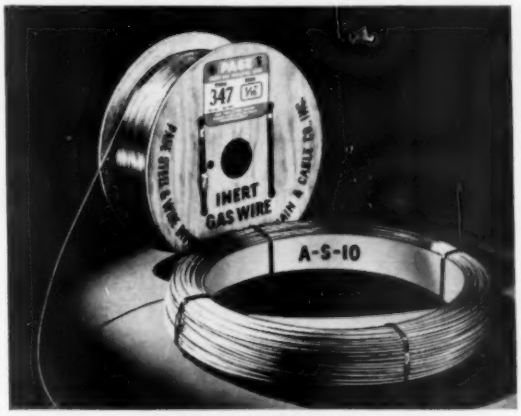

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PAGE *Pay-off-paks* permit *continuous feeding of wire up to 600 lbs.* (from 20" *Pak*) *or 850 lbs.* (from 23" *Pak*) *without rethreading.* Both *Pay-off-paks* and lightweight *Leverpaks* (*not illustrated*) give protection against distortion and corrosion...are easily opened, resealed, handled, stored. Palletized when requested.

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- **Welding Rod Comparison Chart**

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TABLE I—Simplified chemical analyses of stainless steel filler metals

AWS-ASTM Classification No.	Carbon (%)	Chromium (%)	Nickel (%)	Molybdenum (%)	Columbium plus Tantalum (%)
E 308, ER 308	0.08 max.	19	9	—	—
E 308 ELC, ER 308 L	0.04 max.	19	9	—	—
E 309, ER 309	0.15 max.	25	12	—	—
E 309 Cb	0.12	25	12	—	0.7-1.0
E 309 Mo	0.12	25	12	2-3	—
E 310, ER 310	0.20 max.	25	20	—	—
E 310 Cb	0.12	25	20	—	0.7-1.0
E 310 Mo	0.12	25	20	2-3	—
E 312	0.15	29	9	—	—
E 316, ER 316	0.08 max.	18	12	2-2.5	—
E 316 ELC, ER 316 L	0.04 max.	18	12	2-2.5	—
E 317, ER 317	0.08	18	12	3-4	—
E 318	0.08	18	12	2-2.5	6 x C min. to 1.00 max.
E 330, ER 330	0.25 max.	15	35	—	—
E 347, ER 347	0.08	20*	10	—	8 x C min. to 1.00 max.
E 410, ER 410	0.12 max.	12	—	—	—
ER 420	0.25-0.40	12	—	—	—
E 430, ER 430	0.10 max.	16	—	—	—
E 502	0.10 max.	5	—	0.45-0.65	—

**Chromium shall be 1.9 x Ni, min., when so specified.*

on a number of stainless base metals, including AISI types 301, 302, 302B, 304, 305 and 308.

The stainless welding neophyte is reluctant to weld 301 or 302 stainless base metal with 308 filler metal. His discomfort is akin to that encountered by others who weld low-alloy, high-tensile base metals with filler metal of different chemistry. Experience, however, shows the practicality of these procedures. They work.

A special note regarding AISI type 303 base metal: this is a free-machining stainless utilizing selenium in much the same manner as sulphur is employed in free-machining carbon steels. Here, too, lime-base coated stainless electrodes are preferred.

Impaired Resistance

Many austenitic stainless steels of the 300 series become sensitized by exposure during fabrication or in service to temperatures in the range between 900 and 1,500 F. Grain boundary chromium-carbide precipitation results in impaired corrosion resistance.

Carbide precipitation is blocked if base and weld metal carbons are kept below 0.03 and 0.04% respectively, or if stablized base and filler metals are used where columbium combines with the carbon. Proper annealing after sensitization can restore the most desirable corrosion-resisting properties.

In Table I, chemical analysis for 308 filer metals is reported as 0.04% maximum. Actualy, all *ER* fillers are reported in terms of the wire analysis itself, which is 0.03% maximum.

This same limit is used also for most base metals of the extra-low-carbon variety. However, experience has indicated that 0.04% maximum carbon in the weld deposit from coated electrodes of the *E* series is adequate.

All *E* series fillers in Table I are listed according to weld deposit analysis. This is necessary because a number of alloying ingredients, as well as chromium to replace that lost during arc transfer, are added through the coating.

25-12 Alloys

Well known for heat-treating furnace parts, where they possess excellent resistance to oxidation, E309, ER309, E309 Cb and E309 Mo are 25-12 compositions.

Steels of this composition operate satisfactorily without excessive scaling to temperatures of 2,000 F. Naturally, 309 filler metals are used to join parts of the same composition—and when severe corrosion environments might adversely affect the weld deposit, 309 filler is specified for 308 stainless base metal.

Additionally, 309 filler metals have been applied to dissimilar metal joining problems. Among these are the welding of type 308 stainless to mild steel, welding the clad side of 308-clad steels, and applying 12% chromium sheet liners to the inside of mild or low-alloy steel oil refinery vessels.

Type E309 Cb is available either to provide stabilizations against intergranular corrosion or greater strength in elevated temperature service. Similarly, this analysis is preferred for welding type 347 or 321 clad steels, or these same stainless types to mild steel.

Type 321 stainless base metal uses titanium for carbide stabilization. Filler metals of type 321 are not manufactured, primarily because the titanium is oxidized away during arc transfer with coated electrodes. It is possible, however, that a 321 filler metal would perform satisfactorily with either the Mig or Tig processes.

Good for Armor Plate

Type E309 Mo can be chosen for welding type 316 clad steels, or for joining types 316 or 317 to mild steel.

Type 25-20 members of the austenitic stainless filler metal family—E310, ER310, E310 Cb and E310

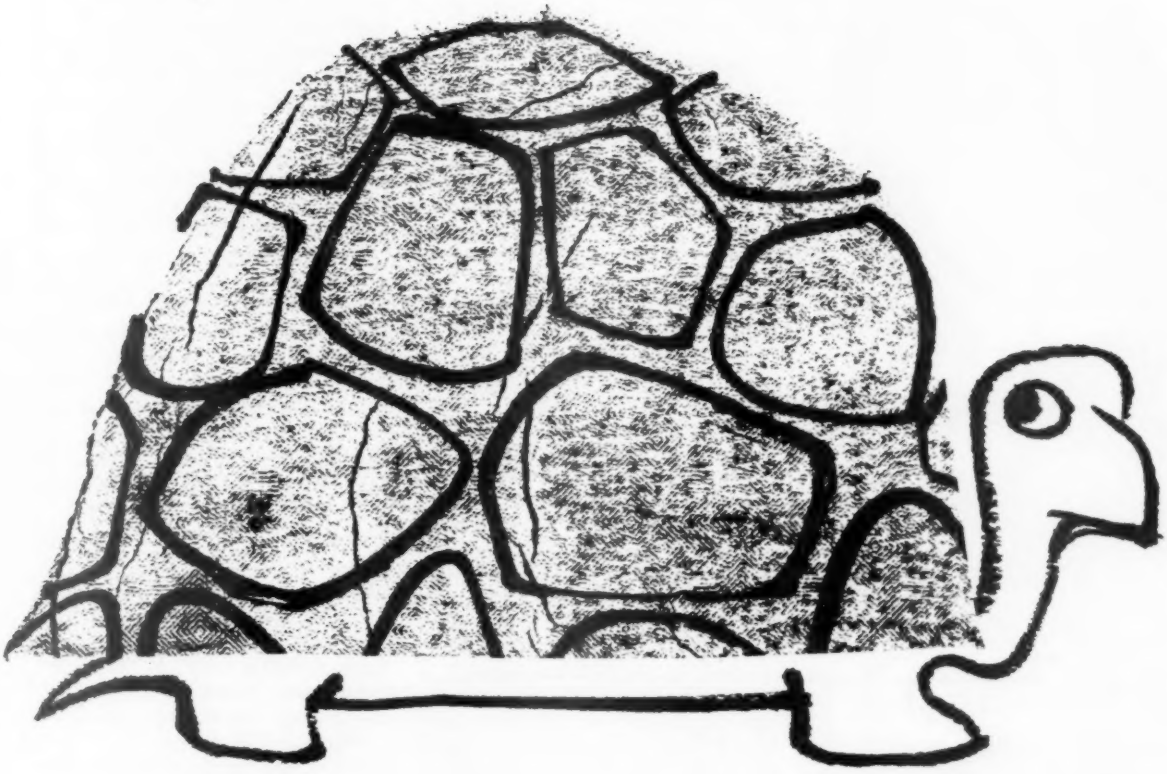

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TABLE II—Tensile requirements for all-weld metal specimens

AWS-ASTM Classification No.	Tensile Strength (min., %)	Elongation in 2 in. (min., %)	Heat Treatment
308	80,000	35	None
308 ELC	75,000	35	None
309	80,000	35	None
309 Cb	80,000	30	None
309 Mo	80,000	35	None
310	80,000	30	None
310 Cb	80,000	25	None
310 Mo	80,000	30	None
312	95,000	22	None
316	80,000	30	None
316 ELC	75,000	30	None
317	80,000	30	None
318	80,000	25	None
330	75,000	25	None
347	80,000	30	None
410	70,000	20	*
430	70,000	20	**
502	60,000	20	*

**Specimen shall be heated to between 1,550 and 1,600 F and held for 2 hours, furnace cooled at a rate not exceeding 100 F per hour to 1,100 F, then air cooled.*

***Specimen shall be heated to between 1,400 and 1,450 F and held for 4 hours, furnace cooled at a rate not exceeding 100 F to 1,100 F, then air cooled.*

Mo—were designed originally for welding base metal of the same composition. Later, it was discovered that type 310 weld deposits possessed excellent ballistic properties in joints between hardenable armor plate steels.

Large tonnages were channeled into such weldments during World War II until the resulting prodigal use of desperately needed alloys inspired a search for substitutes. Successful research led to the 19-9 Mo, 19-9 Mn stainless types for heavier armor, and manganese-moly lime-base electrodes for armor less than 1.5 in. thick.

Like the 309 varities, 310 filler metals (including the 310 Cb and 310 Mo) can be employed for joining clad steels or stainless to mild and low-alloy steels.

Since austenitic stainless steels such as the 310 types have a well deserved reputation for welding hardenable steels of unknown analyses, a word of caution is in order.

Well-meaning engineers have welded hardenable gears to shafts with 25-20 filler. The resulting welds were excellent. Upon heat-treating the assemblies, however, these same engineers were crestfallen to see welds break away due to differences in coefficients of expansion between base and weld metals.

The 29-9 composition known as type 312 (E312) performed with expected good results when applied to base metal castings of the same composition. This analysis later proved outstanding for welding dissimilar metal compositions where one component is high in nickel.

Two-Phase Deposit

The two-phase weld deposit produced by a 312 alloy contains substantial percentages of ferrite in an austenite matrix. Notwithstanding considerable dilution by the austenite-forming nickel, the two-phase microstructure persists. As a result, the ferrite-rich austenitic structure proves highly resistant to weld metal cracks and fissures.

For a while, the specially heat-treated, low-alloy, high-strength steels were welded with type 312 filler. Freedom from cracking during fabrication, coupled with trouble-free field performance of huge earth-moving structures, were behind this alloy choice.

Also developed for welding base metals of the same composition were the 18-12-2 Mo filler metals—E316, ER316, E316 ELC and ER316 L. Specific resistance to a pitting type of corrosion has been attributed to these alloys.

In addition, they have proved highly desirable in some high-temperature service environments up to 1,650 F. Well-known benefits of molybdenum for improving creep resistance also show up in these alloys.

Customary stability from intergranular corrosion explains the presence of the E316 ELC and ER316 L analyses. Some impairment of high-temperature performance would be anticipated because of the reduced carbon content.

Corrosion Resistant Trio

A trio of 18-12-3 Mo filler metals (E317, ER317 and E318) are intended for a specific corrosion-resistant service. When exposed to severe corrosion environment involving sulphuric and sulphurous acids and their salts, these compositions perform well. The E319 is the columbium-bearing cousin of the E317 alloy for customary stabilizing effect.

Another heat-resisting alloy, the E330 and ER330, is the 15-35 type used for heat and scale-resisting services above 1,800 F. Both cast and wrought forms are fabricated—and casting repairs are carried out—with type 330 filler metal.

Either 19-9 ELC or 19-9 Cb filler metals (E347, ER347) may be selected to avoid the difficulties of integranular corrosion due to carbide precipitation. Filler metals of the 347 type contain columbium and tantalum which work together to seize carbon. Furthermore, both columbium and tantalum improve high-temperature service attributes.

Long-term service at elevated temperatures, such as those encountered in the power generation industry, has disclosed some 347 cracking problems. These are believed to be associated with the ferrite content of the weld metal. Specifications, therefore, recommend a minimum chromium-nickel ratio.

Caution is necessary, since too much ferrite is undesirable. This is an area in which expert counsel is needed if the designer has the slightest doubt about what he is doing.

Tends to Air-Harden

In a straight chromium alloy containing 12% chromium (E410, ER410), a problem exists because of an air-hardening propensity. Both preheating and postheating become essential parts of the welding procedure in order to achieve sound welds with serviceable ductility.

Two common areas of use are encountered with type 410 filler metals. One, of course, is for joining base metals of similar composition. The other is as a surfacing deposit on carbon steels for corrosion, erosion or abrasion resistance such as occurs in valve seats or other valve parts.

Somewhat higher carbon content distinguishes the ER420 (12% chromium) filler metal from the 410 type. In such applications, it combines the excellent corrosion resistance of a chrome stainless steel with a harder, more abrasion resistant wear property.

Last of the common straight chromium filler metals is type 430 (E430, ER430), containing about 16% chromium. Since too much chromium tends to reduce ductility, every effort should be made to specify just enough chromium for desired corrosion resistance.

Generally pre- and postheating are part of a workable welding procedure. The best balance of mechanical properties and corrosion resistance is achieved after suitable postweld heat treatment.

Refinery Favorite

The 5 Cr-½ Mo filler metal (E502) has been a favorite in oil refinery service. It is most commonly used to weld piping and tubing of the same composition. Because this alloy is also air-hardening, suitable pre- and postheating treatments must be included in the welding procedures.

Table II summarizes mechanical properties of corrosion-resisting steel weld deposits. Columbium-bearing stainless steels show some 5% less ductility than equivalent analyses without columbium.

Examples occur in 308 vs 347, 309 vs 309 Cb, 310 vs 310 Cb and in 317 vs 318. A strength penalty of 5,000 psi is extracted for ELC types —*e.g.*, 308 vs 308 ELC and 316 vs 316 ELC. For these reasons, it is not right to specify Cb-bearing or ELC stainless filler unles the welding procedure or service conditions demand these modifications.

Here are good rules to follow when bare stainless wire is used with arc welding processes:

Light-gage metal (less than 1/16 in. thick) is better welded with the Tig process using d-c straight polarity and argon as a shielding gas. The argon arc is colder than a helium arc, giving less penetration, and thus works better for sheet metal service.

Preference for Mig

Mig welding can be done either with argon or helium. There is a preference for helium on the part of some operators. Mig is faster than Tig and should be used wherever minimum base metal thickness (about ⅛ to 3/16 in.) and joint design permits.

Submerged-arc welding is the most economical process wherever it is applicable. Either d-c reverse polarity or a-c power sources work satisfactorily. Basic fluxes conserve chormium and other elements and hold the silicon increase of the weld deposit within bounds.

Most stainless welding, like most carbon steel welding, is carried out by manual methods using coated electrodes. However, the automatic processes and the Tig process represent a higher percentage of the total with stainless steels.

Coated stainless electrodes are classified as EXXX-15 or EXXX-16. The EXXX-15 are lime coated and contain less than 8% Ti O_2 in the coating. These electrodes are almost always uesd with d-c reverse polarity only.

Improved Stabilization

The other classification, EXXX-16, is useful with d-c reverse polarity or with a-c. The coating may be a modified lime type containing up to about 8% Ti O_2 or a titania type containing appreciably more Ti O_2.

In either the lime or titania varieties of EXXX-16 electrodes, a-c arc stabilization is improved through such a readily ionized element as potassium.

Both classifications are considered useful in all welding positions with electrode diameters of 5/32 in. or smaller. For vertical welding, particularly for the first pass, many weldors prefer lime-type electrodes. For flat position groove welding, weldor preference generally leans toward titania electrode types. The latter produce concave rather than convex groove beads. Sometimes the titania slag is more readily removed.

Stainless steel filler metals are abundant, and there are many excellent welding processes among which the welding engineer may choose on the basis of economic considerations.

Danny says:

"Slag removal is a snap with Airco 78E electrodes"

I find that easy slag removal is just one of the many advantages of Airco 78E electrodes. This deep penetrating, all position electrode produces high quality weld metal which sets up rapidly. It's free from porosity, even when welding in the vertical down position. I especially recommend it for welding mild steel where high ductility and tensile strength are essential.

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A manufacturer's viewpoint . . .

Properly used, E6024-27 types have real value

(On page 41 of its February, 1957, issue, WELDING ENGINEER *presented the views of Harold Hicks, International Steel Co., on an article by Orville T. Barnett which appeared in the December, 1956, issue. Mr. Barnett had discussed iron-powder electrode types, and Mr. Hicks felt that, as a user of these electrodes, he possessed some additional information that would be of value to readers of this magazine.*

(To the facts, figures and opinions expressed by Mr. Barnett, the evaluator, and Mr. Hicks, the consumer, we now add those of Mr. Hinkel, who represents a producer of iron-powder electrodes. We hope that this unexpected, but fully developed round-table of opinions offers much that is of value to other readers.)

WE AGREE with many of the statements made by Mr. Hicks, and wholeheartedly with the headline: "Iron-powder E6024's are no panacea." To the latter, however, we would add ". . . and neither is any other single electrode type."

It is our observation that iron-powder electrodes offer spectacular improvements in certain respects, but tend to be more highly specialized in their application possibilities. (But don't we also have specialists for certain bodily ailments, as well as general practitioners?)

Any electrode is admittedly a compromise. Every electrode marketed represents the designer's best efforts to utilize characteristics he thinks are important, and to avoid those which he feel are not imperative for the application in mind. Only time and a sales pattern will indicate the wisdom of his choice.

On the basis of large-volume sales, we have to admit the designer did pretty well in deciding E6024's had considerable merit.

Accentuate the Positive

Recognizing limitations as well as virtues of a product is a responsibility the manufacturer must always face. Unfortunately, however, product limitations do not make interesting advertising copy. The answer, we believe, lies in thorough education of all sales personnel so they may do a constructive job of sales engineering.

It is the manufacturer's job to recommend only those products which can improve quality or cost or both. Any qualified sales engineer, for example, should know that, because of the need for deep penetration and freedom from slag interference, E6010-11 and E6010-7016 types are excellent for stringer beads. He should also know that an E6024 would suffer by comparison in this application. However, this qualified representative would be able to recommend E6024 use after the stringer bead is applied so the user could take advantage of its higher deposition rate.

We take issue with Mr. Hicks when he states: "It is impractical to make multiple-pass, horizontal fillets with an E6024." He probably refers to irregular bead appearance which sometimes results on joints of this type.

Although this condition indicates a waste of weld metal, it is almost entirely a matter of proper weldor technique. If each individual bead is not placed where it belongs, the result is unimpressive. When done correctly, rewards are many: higher arc speed, self-removing slag and virtual elimination of spatter.

Optimum Current Range

All electrodes have a relatively narrow optimum current range, and iron-powder E6024-27's differ from this rule in only one respect: they do not perform badly at excessive currents as do conventional types.

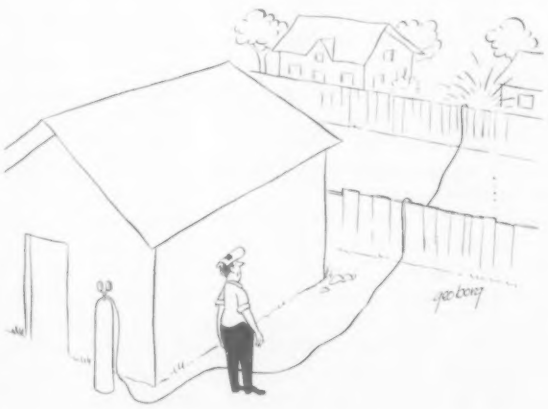
Spatter, undercutting and slag and removal problems have been *designed out* of iron-powder electrodes, but if the factor which gives pleasing arc characteristics (*i. e.*, adherence to optimum current range specifications) is misused, the absence of danger signals will be a liability.

The attainment of proper current should be treated as a procedure control problem; in extreme cases, it may be necessary to lock the machine setting. In many cases, frequent use of tong meters has corrected bad practices.

We were particularly surprised by Mr. Hicks' enthusiastic comments regarding low-hydrogen iron-powder electrodes. They offer real improvements over conventional low-hydrogen types, and we feel they are here to stay, but their advantages are considerably less impressive than those which can be recognized in comparing an E6012 or 6013 type. As a reader, we would be interested in other users' comments on this subject.

The exchange of ideas between user and manufacturer always brings us a little closer to the real problem. For this reason, we hope Mr. Hicks will continue to call them as he sees them, and that others will be encouraged to do likewise.

Jerry Hinkel
Application Engineering
The Lincoln Electric Co.



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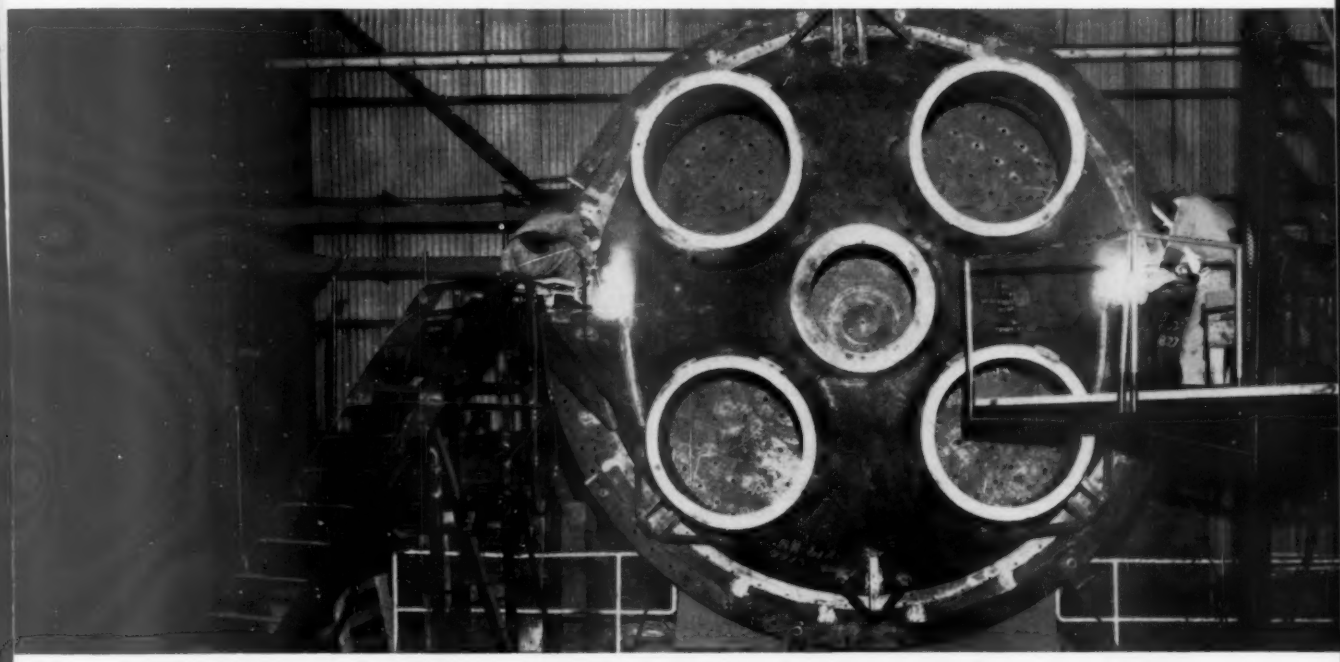

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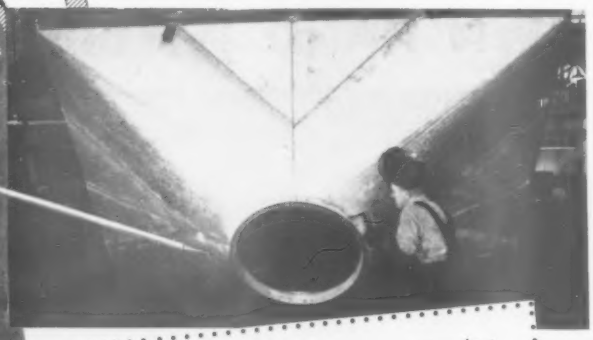

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4. A minimum of joint preparation is necessary.
5. Beads are smooth — penetrate uniformly.
6. Deposit mechanical properties compare to those of the base metal.

Ampco-Trode 10 performs profitably also in metal-arc welding of brasses, aluminum bronzes, silicon bronzes, some nickel alloys, dissimilar metals — and overlaying bearing, corrosion- and wear-resisting surfaces.

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BURN-BACKS in Mig welding of magnesium have been ended by a new device.

Magnesium gets the Mig treatment

A NEW welding technique which permits semi-automatic, continuous welding of magnesium has been developed by Lite-Line Metal Industries Div. of Copperloy Corp., Cleveland, Ohio.

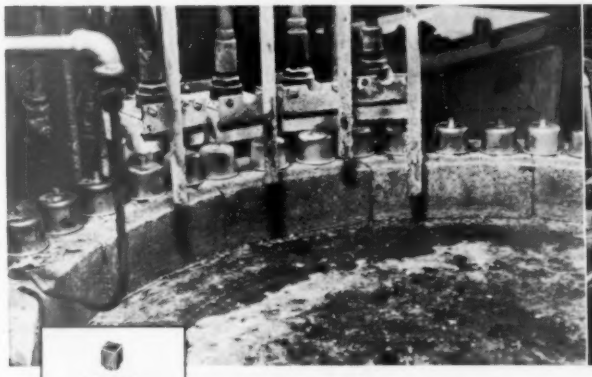
Utilized is the Mig process with small-diameter wire. Although widely applied to other metals, Mig has never before been successfully adapted to welding magnesium.

Burn-backs, caused by difficulty in maintaining constant electrical contact between electrode wire and the current-carrying sleeve, have long been a problem when welding magnesium. A new device patented by Lite-Line, however, has solved this problem and made semiautomatic welding of magnesium—and aluminum—completely feasible.

Conducting tests under production conditions, the firm made continuous welds up to 30 ft in length. In addition, good results were obtained in Mig welding heavy magnesium sections, plates ($\frac{1}{8}$ in. thick and over), structural shapes and castings.

Advantages claimed by the company for Mig welding magnesium are reduction in welding time—four to six times faster than manual arc hand welding. And that the weld penetration is up to three times greater.

JOIN WITH HANDY & HARMAN SILVER BRAZING FOR PERMANENT PROFIT



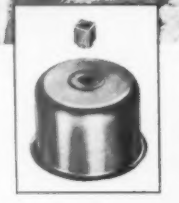


Table Lighter Cup – Spindle and cup are "painted" with a rich mixture of 180-mesh EASY-FLO 45 and HANDY FLUX in paste form. They are placed on revolving table which passes them under four gas-air burners in a 15-second heating cycle. The closing-spring latch is joined to the top of this lighter by torch brazing with EASY-FLO 45 Rod.

Pocket Lighter Top Assembly – This consists of the lighter top, wick housing, flint housing and cover spring housing, and requires three brazed joints. Parts are first assembled and dipped in HANDY FLUX. Next, operators place a single wire preform (EASY-FLO 45) which covers all three joints. Brazing is automatic as table carries assemblies under burners.

How RONSON® Makes Cigarette Lighters by the Hundred Thousand with EASY-FLO 45 Brazing

Here is a real "example in volume" of the advantages of Handy & Harman silver alloy brazing. Ronson Corporation, manufacturer of the world's best known lines of pocket and table lighters, meets its high-production joining requirements with simplicity, sureness and economy.

Everything Ronson requires – life-of-the-lighter strength, leak-tight joints and fast, easy assembly – is provided by silver brazing with EASY-FLO 45 and HANDY FLUX. Joining thousands of assemblies a day, for both table and pocket model lighters, is economical. The cost per joint is reckoned in mills.

This is an example that tells the silver brazing story all by itself – speed, strength, economy, low labor costs – all help make a product that everyone knows and millions use. That's how Handy & Harman alloys help make Ronson a name to depend on. How about your product? Could it use this remarkable joining method? Find out for yourself. Call Handy & Harman today.

TAKE A LOOK

. . . at Bulletin 20. This concise introduction to silver alloy brazing talks about joining methods, as well as joint design and economies that can be enjoyed with EASY-FLO brazing. We'll send you a copy whenever you request it.

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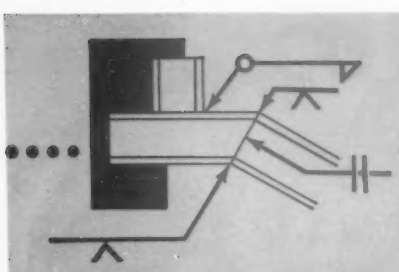

the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Welding won't injure the eyes

Question:

Over the past few months, my fellow workers at this government installation have often discussed the effects of a welding arc upon the eyes, and the distance at which arc flash may be harmful. I have been welding for the past 17 years and my eyes are normal for my age. This leads me to disagree with shopmates who take the view that welding is always harmful to the eyes. Could you straighten us out?

Answer:

You are entirely correct in the belief that welding will not harm the eyes of a weldor. There are, of course, cases of "flashed eyes" which prove irritating. But this same effect is also noted when eyes are sunburned. Like sunburned skin, the eyes will improve in a day or so; the experience is disagreeable, but not necessarily harmful.

There is a difference of opinion regarding immunity distance for those not wearing protective devices when working near a weldor. It is generally conceded, however, that persons 30 ft away from an arc being used outdoors will not experience eye trouble.

Those who work indoors within 50 to 75 ft of a welding arc should wear a No. 4 or 5 shaded lens to protect against reflected flashes.

Medical Authority

On the subject of possible injurious effects of welding upon the eyes, this is what a leading medical authority had to say in *The Welding Encyclopedia*:

"Despite the many hazards apparently at hand to damage weldors' eyesight, little actual harm is done. By developing adequate protective lenses, modern science has removed whatever danger might have been inherent in this occupation.

"Medical authorities have investigated effects of welding upon the eyes and have been unable to find any indications of visual deterioration or other ocular damage that might occur as a result of working as a weldor.

"Periodic examinations by organizations employing many weldors tend to substantiate these facts. It is of the utmost importance, however, that protective devices and procedures are not neglected."

Question:

Since we are starting to produce some commercial products that have to be more carefully finished in our small shop, we are going to use portable grinding wheels. We have only slight experience in grinding, and none of us has ever dressed a wheel. Could you give us the procedure?

Answer:

Frequently, before a grinding wheel can be dressed, it must be *trued*. In this operation, a wheel face is "squared up" by the removal of some material so that the full face area can contact the workpiece. To achieve needed accuracy in truing, mechanical or abrasive devices, or a diamond tool post are used.

The dressing operation should be viewed as virtually a continuous process. Every grinding wheel benefits from the dressing, which "opens up" the wheel face—*i.e.*, removes worn abrasive particles and agglomerated workpiece shavings to expose fresh abrasive grits.

Dressing material is itself an abrasive—and for obvious reasons, it must be a tougher stock than that used on the grinding wheel. Supplied in stick form, dressing stock is held in the hand and applied to the wheel face for whatever time is needed to open up the face.

When worn wheels have been trued, the dressing operation must be carefully done so that the sharp corners which have just been obtained are not broken down. Even touch-up dressing between truing operations, of course, demands this same care.

Question:

What is a welding engineer, and what qualifications must he possess?

Answer:

A Welding Engineer is one who, by reason of his special knowledge of the mathematical and physical sciences, and the principles and methods of engineering analysis—knowledge acquired by professional education and/or practical experience—is qualified to practice welding.

As defined by the American Welding Society, the practice of welding engineering "involves a knowledge of these basic engineering areas:

(*1*) "Design of machines, structures, equipment, and of suitable connections.

(*2*) "Materials of engineering—particularly metals, gases and refractories.

(*3*) "Processes, procedures and equipment of the welding industry."

These definitions are certainly not perfect—and they may not even be adequate. They are, however, a step in the right direction of delineating a Welding Engineer's work and qualifications.

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—*Courtesy Livesay, Inc.*

OPERATOR preparing flame-cutter for vertical cut down side of deck house. Note track in photograph.

Workers discover . . .

All-position flame-cutter eases shipyard tasks

YARDS engaged in reconditioning ships are finding the job greatly simplified by a flame-cutter which moves in all directions rather than on a horizontal plane alone.

Usually, out-of-position cuts must be done by manual operation, which is extremely awkward and time-consuming. This new cutting machine, however, which moves along an aluminum track or rail, eases and speeds up the process.

Tack-welded anchor studs hold the track firmly to the surface to be cut, whether it be vertical, overhead, or angular. The machine's wheels fit into the grooved track while a driving gear beneath the carriage engages a steel gear rack on the rail face. This system insures a positive drive under all conditions and also insures traction while making a vertical cut.

The tractor can be controlled for both travel speed and travel direction. Position of the cut has no effect upon cutting speed nor upon cutting quality. And either a straight or bevel-edge cut may be made.

WELDOR here is priming previous to welding set up. New flame-cutter moves in all directions.

Here, finally, is a flame-cutter that will cut in all positions—including overhead—but still offers completely mechanical operations.

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Saves Effort!

Lighter weight and superior flexibility lets you weld faster and easier on every job . . . less operator fatigue!

Type D-866 *Aluminum* Welding Cable is available in all standard sizes from General Cable.

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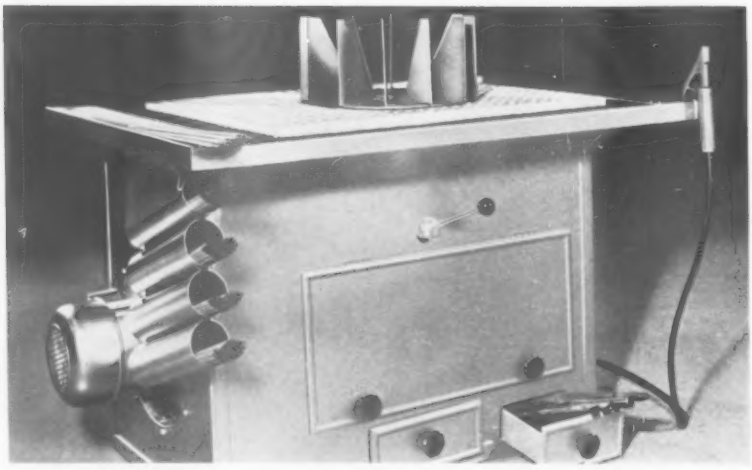

NEW welding bench manufactured by West German company is designed to exhaust welding fumes in a new way. The unit is transportable.

Transportable, adjustable German welding bench

By Vivian Bird

A WEST GERMAN firm specializing in the manufacture of air conditioning equipment—Robert Hildebrand Maschinenbau GmbH of Oberboihingen, Wurtemburg — claims to have solved the problem of exhausting welding fumes in a completely new way.

The modern welding bench shown in the illustration is said to meet fully demands of the most up-to-date shop. It was displayed during the Hannover Technical Fair from April 28 to May 3, 1957.

Overall dimensions for the bench are 2 ft, 7½ in. high, 3 ft, 7½ in. long, and 2 ft, 7½ in. deep. The main features of the bench are as follows:

(1) A removable grid lattice top with electrode storage trays on both sides of the bench. The weldor can work either sitting or standing. Special attention has been paid to efficient distribution of exhaust and care is exercised to insure a sufficiently large air capacity. Should it be necessary to inspect the fume exhauster it may be reached through removable doors.

(2) The welding bench is adjustable to accommodate unwieldy work pieces which have to be welded from the floor.

(2) Four large containers for electrodes are arranged on the left hand side.

(4) An insulated container is on the right hand side for holding welding tongs; the latter is provided with rubber sleeves to insulate them from the bench top.

(5) Fume extraction takes place by means of suction hoods with provision for special interconnections between hoods to deal with particularly awkward work pieces. A receptacle is built into the bench bottom to collect welding residue. The right hand drawer is used for welding tool storage. The bench can be supplied as a transportable unit.

"Moley's got the hiccups again."

See Your

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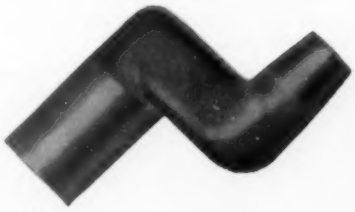

Your local Mallory Distributor stocks a broad selection of Mallory standard welding electrodes, in a diversified line of sizes, shapes and alloys. He also stocks Mallory electrode holders, bar stock and seam welding wheels — available in many designs, for a variety of pressures and applications. Mallory Distributors can advise on special welding problems, or call on Mallory production and engineering facilities for special requirements . . . assuring prompt *local* service on every resistance welding need.

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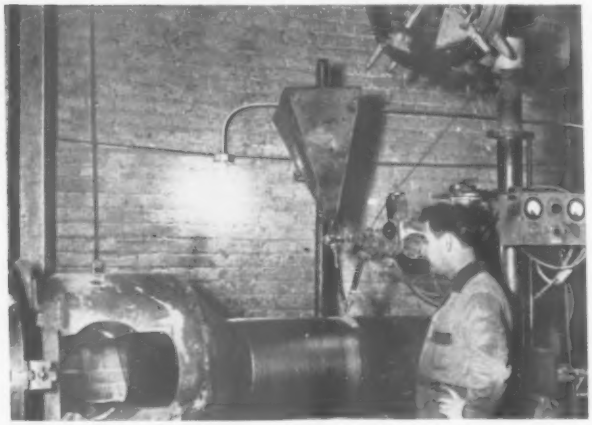
ALL-position Mig welds on mild steel are done semiautomatically with this gun produced by General Electric Co. Carbon dioxide is the shielding gas, and wire as small as 0.035 in. in diameter may be used.

On the job...

HARDFACING worn cylindrical parts saves expensive replacement. This lathe, used with an automatic submerged-arc welder manufactured by Linde Co., handles parts up to 54 in. in diameter and 18 ft. long. Work is done by Great Lakes Welding Co., Detroit.

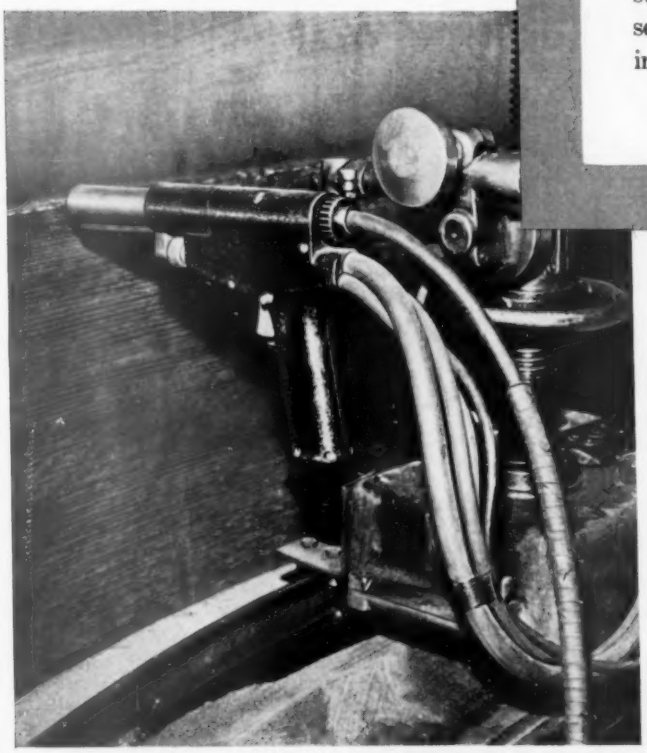


BOEING Aircraft Co. Tig welds many titanium components in this inert-gas-filled plastic bag. Completely inert atmosphere permits welding without base metal contamination. Scene is from movie produced by Mallory-Sharon Titanium Corp.

WELDOR is dwarfed by—and seems in danger of falling into—60-in.-diameter iron pipe. The corrosion-resistant pipe, supplied by A. M. Byers Co., was installed in an Orlando, Fla., power plant.

Crucible Stainless Automatic Welding Wire for *cleaner, faster, sounder welds*

Crucible stainless automatic welding wire is quickly available from local stocks—in the widest range of analyses. It's packaged to fit your needs—in spools or layer wound coils.



This is the interior wall of a kraft digester used in a leading pulp mill. A stainless weld overlay is applied automatically by the inert gas consumable electrode process. 6,000 pounds of Crucible Rezistal stainless, overlay welding wire 1/16" was used to cover 1,400 square feet of area. The cost: one-third that of vessel replacement.

Next time you need welding wire—call Crucible. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

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Welding copper and copper-base alloys—Part IV

(For more on copper and copper-base alloys, see WELDING ENGINEER for July, 1956, p. 69; August, 1956, p. 53, and December, 1956, p. 75.)

Alloy	Soft Soldering	Brazing	Oxyacetylene Welding	Carbon Arc Welding	Gas Shielded Arc Welding	Metal Arc Welding	Resistance Welding
ELECTROLYTIC TOUGH PITCH COPPER (ETP)	E	G	NR	F	F	NR	NR
DEOXIDIZED COPPER, HIGH RESIDUAL PHOSPHORUS (DHP)	E	E	G	F	G	NR	NR
OXYGEN-FREE COPPER (OF)	E	E	G	F	E	NR	NR
GILDING, 95%	E	E	G	F	G	NR	NR
COMMERCIAL BRONZE, 90%	E	E	G	F	G	NR	NR
JEWELRY BRONZE, 87.5%	E	E	G	F	G	NR	F
RED BRASS, 85%	E	E	G	F	G	NR	F
LOW BRASS, 80%	E	E	G	F	G	NR	F
CARTRIDGE BRASS, 70%	E	E	G	F	G	NR	F
YELLOW BRASS	E	E	G	F	G	NR	F
MUNTZ METAL	E	E	G	F	G	NR	G
LEADED COMMERCIAL BRONZE	E	G	NR	NR	NR	NR	NR
LOW-LEADED BRASS (TUBE)	E	G	F	F	F	NR	F
LOW-LEADED BRASS	E	G	F	F	F	NR	F
MEDIUM-LEADED BRASS	E	G	NR	NR	NR	NR	NR
HIGH-LEADED BRASS (TUBE)	E	G	NR	NR	NR	NR	NR
HIGH-LEADED BRASS	E	G	NR	NR	NR	NR	NR
EXTRA-HIGH-LEADED BRASS	E	G	NR	NR	NR	NR	NR
FREE-CUTTING BRASS	E	G	NR	NR	NR	NR	NR
LEADED MUNTZ METAL	E	G	F	F	F	NR	NR
FREE-CUTTING MUNTZ METAL	E	G	NR	NR	NR	NR	NR
FORGING BRASS	E	G	NR	NR	NR	NR	NR
ARCHITECTURAL BRONZE	E	G	NR	NR	NR	NR	NR
INHIBITED ADMIRALTY	E	E	F	F	F	NR	F
NAVAL BRASS	E	E	G	F	F	NR	F
LEADED NAVAL BRASS	E	G	NR	NR	NR	NR	NR
MANGANESE BRONZE, (A)	E	E	G	F	F	NR	G
ALUMINUM BRASS	F	G	F	F	F	NR	G
PHOSPHOR BRONZE, 5% (A)	E	E	F	G	G	F	G
PHOSPHOR BRONZE, 8% (C)	E	E	F	G	G	F	E
PHOSPHOR BRONZE, 10% (D)	E	E	F	G	G	F	E
PHOSPHOR BRONZE, 1.25% (E)	E	E	F	G	G	F	F
FREE-CUTTING PHOSPHOR BRONZE	E	E	NR	F	G	F	F
CUPRO-NICKEL, 30%	E	E	F	NR	E	E	G
CUPRO-NICKEL, 10%	E	E	F	NR	E	G	G
NICKEL SILVER, 65-18	E	E	G	NR	F	NR	E
NICKEL SILVER, 55-18	E	E	G	F	F	NR	E
NICKEL SILVER, 65-15	E	E	G	NR	F	NR	E
NICKEL SILVER, 65-12	E	E	G	NR	F	NR	E
NICKEL SILVER, 65-10	E	E	G	NR	F	NR	E
HIGH-SILICON BRONZE, (A)	E	E	G	E	E	F	E
LOW-SILICON BRONZE, (B)	E	E	G	E	E	F	G

E — Excellent F — Fair G — Good NR — Not Recommended

—*Courtesy Copper & Brass Research Ass'n*

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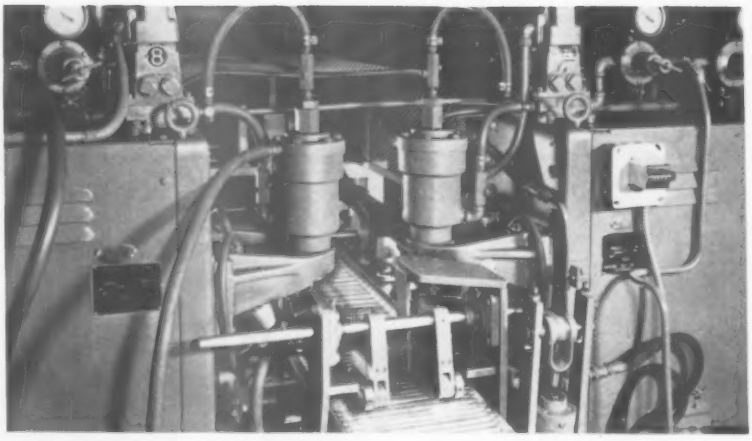
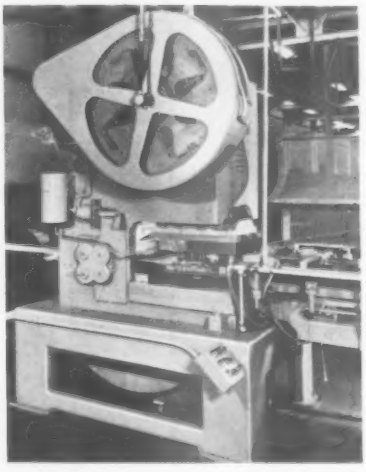


BENCH welders above make 38 welds on two stampings after they are formed by press below. Production rate is 120 units per hour.



For blower wheels:

A press-welder "marriage" hikes production

CLOSELY INTEGRATED high-speed stamping and resistance welding operations make an ideal production "marriage." Such a fabrication package for blower wheel production turns out up to 150 blower wheel cages per hour for an air-conditioning manufacturer.

Stamping, assembling and welding are the three production steps—and all are done without an operator. Completed subassemblies are rolled and beaded to complete blower wheels.

Easy Line Changes

All equipment for stamping, welding and indexing of subassemblies was designed and built by Precision Welder & Flexopress Corp., Cincinnati, Ohio, in cooperation with Mayne Products Co. of Dayton. Line changes are easily made to accommodate different wheel sizes.

Strip steel is fed into a 75-ton press through an integral-feed mechanism that provides precise stock advance. The press operates at 120 strokes per minute to pierce, lance and form blower louvers.

Special tooling transfers a completed stamping 3 ft. and drops it onto conveyor tracks. A second stamping is interlaced with the first, accurately positioned, and both are indexed to the welding station.

Welding Equipment

Two standard bench welders outfitted with special tooling automatically index the joined stampings and weld them 38 times. The welders are rated at 30 kva. Adjustable limit switches automatically start an electronic timer which controls both weld sequence and indexing.

The manufacturer employing this equipment has pointed out that integration of stamping and welding from the outset of production has enabled his firm to accurately sequence production rates of the machines.

These detailed studies have led to top production rates with both press and welder operating at peak efficiency.

IT'S THE *MOST

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the Sensational *NEW*

miller GOLD STAR SR

It ***DELIVERS*** maximum arc stability for:

a. Sounder, denser welds – and more of them – in less time, with . . .

b. ALL electrodes, in . . .

c. Any and all positions

How is this performance possible? THE MILLER GOLD STAR SR introduces a...

NEW transformer

plus

NEW weld stabilized current

plus

NEW completely sealed semi-metallic rectifier

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Tested across the country by practical, critical, hard-bitten working weldors, here's what they say about the new Miller GOLD STAR SR:

"it's the DC performance I've always wanted"
"here's DC welding current that's . . . perfect!"
"positively handles ALL electrodes better"
"best deal I've seen for v and o work"
"easiest arc starting in my experience"
"smoothest arc I ever used . . . and . . . quiet!"
* "it's just plain the MOST"

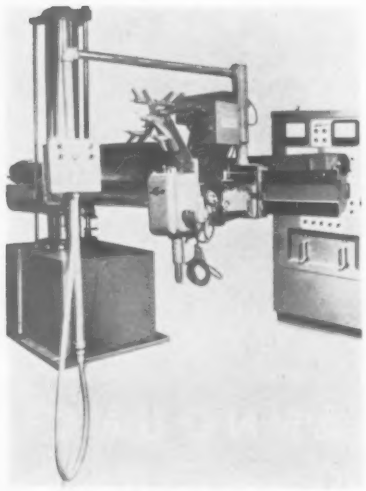
Complete particulars on the MILLER GOLD STAR SR, including inert gas and automatic fixture welding, is now available on request.

". . . if it's Miller you know it's the finest . . ."

miller ELECTRIC MANUFACTURING CO., INC. APPLETON, WISCONSIN

distributed in Canada by CANADIAN LIQUID AIR CO., LTD. Montreal

new products . . . . . USE CARD ON PAGE 91



LEFT: Cart-mounted Mig welder has recirculating pump-driven cooling unit. ABOVE: Automatic fusion welder features radial arm with multiple station, precision positioners. Carriage can be easily unlocked and moved to any position.

Welding unit

SELF-contained Mig welding unit provides mounting space for two argon cylinders and is equipped with recirculating pump-driven cooling unit for torch. Unit includes welder and "Fillerarc" wire drive, is cart-mounted. *Machinery & Welder Co.*

Circle No. 1

Thyratron

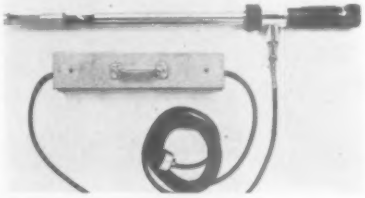
DESIGNED especially for motor control and resistance welding equipment, new Xenon filled thyratron is designated "NL-5665/C16J." Quick starting and wide temperature limits, 18 amp d-c thyratron ratings are: filament volts, 2.5; filament current, 31 amp; maximum peak forward volts, 1000; average anode current, 18 amp; peak anode amp, 100 amp; anode current averaging time, 4.5 seconds; filament heating time, 60 seconds. *National Electronics, Inc.*

Circle No. 2

Spherical corners

PREFABRICATED parts for weldments strengthen and improve structure of wide variety of weldments, states the manufacturer. The u and v-type formed steel braces are made in variety of sizes for use on machine bases, tools, dies, jigs, fixtures and special machinery. Prefabricated spherical corners have smooth, rounded edges. Notch four corners of workpiece, bend edges to desired radius, then weld corner into place. Available in 108 sheet metal sizes and 16 heavy metal sizes, in mild and stainless steel or aluminum. *Conner Steel Products.*

Circle No. 3



Borescope mirror

COMPLETE internal inspection of tanks, vessels and equipment is possible using borescope with adjustable mirror controlled by hand-wheel to permit scanning from all directions. Field of view is 9 in. in diameter at distance of 24 in., magnified to 10th power.

Larger field of vision detects flaws, pits, cracks or deterioration. *Lenox Instrument Co.*

Circle No. 4

Automatic welder

PRECISION radial fusion welder for circumferential and longitudinal welding is automatic. With single control console quick-change welding heads performs Mig, Tig and submerged-arc welding. Radial arm feature uses multiple station, precision positioners. Carriage is low inertia type, easily unlocked and moved to any position. *Welduction Corp.*

Circle No. 5

Power Sources

TWO new welding power sources have been designed for Mig welding. Both are rated 450 amp, 60 cycles. Two-high stacking saves space. Redesigned fan and baffled air ducts reduce noise, phase insulation of motor stators increases life, oversized sealed bearing and constant pressure brushes, according to manufacturer. Top removes to reach controls.

Constant arc length welder will automatically supply proper current for any wire feed speed required. Second unit holds arc voltage constant throughout welding range. *General Electric Co.*

Circle No. 6

BRAZING COSTS CUT 24% TO 82%

...simply by STANDARDIZING on new Westinghouse brazing alloys

Company after company is now achieving *almost phenomenal* reductions in over-all *brazing costs!* They get savings, they say, of 24% to 62% —simply through the following 3 quick, easy steps in planning brazing production:

You merely (1) *List and analyze* your own particular brazing requirements. (2) *Test and prove* the facts for yourself! And then (3) STANDARDIZE on the correct *advanced-type* brazing materials, among those now produced by Westinghouse!

In *many* cases, these technically superior new Westinghouse alloys *also save you $1.00 or more per pound!*

Gas-blanketed extrusion eliminates oxides!

All Westinghouse brazing alloys are now made by *unique, extrusion* methods!—blanketed under inert gas! This *eliminates* the usual oxides that cause most brazing troubles. And produces *new versatility* in a brazing rod—with *exceptional* flow characteristics—*remarkable* ductility—and *unsurpassed* appearance of the finished work!

Production proved—and NOW ANALYSIS CERTIFIED!

All five of these *radically improved* alloys have been *thoroughly* laboratory- shop- and production-tested—throughout vast Westinghouse operations! *Each one* has proved itself *far* superior to *all comparable* brazing materials! And now is ANALYSIS CERTIFIED! —*assuring you* the *same, consistent, best possible* brazing results!

Order *trial* packages, from your local Westinghouse Sales Office, or from your nearest Westinghouse Welding Distributor NOW! You'll *braze better*—at *much lower costs* TOMORROW! J-22083

Select from this MOST COMPLETE LINE OF BRAZING MATERIALS IN THE INDUSTRY!

PHOS-COPPER® — Lowest cost. High fluidity. Very fast brazing alloy. Self-fluxing on copper. Brazing range: 1350° to 1400°. Melts at 1305°F.

PHOS-SILVER* #2—Low cost, but less fluid than PHOS-COPPER—to bridge gaps, and fill "open" joining. Brazing range: 1325° to 1375°. *T.M.

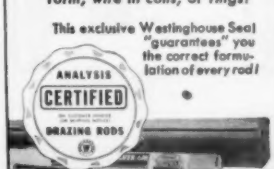
PHOS-SILVER—For critical, tightest joints. Extremely fluid and penetrating! Excellent for brass and bronze. Brazing range: 1225° to 1275°.

PHOS-SILVER 6M — Mushy, easily controlled flow. Off-sets poor fit-up. Bridges 1/16" gaps. Especially ductile! Brazing range: 1275° to 1350°.

PHOS-SILVER 15 — Mushy flow characteristics. Wide melting range. Available for government specifications. Brazing range: 1325° to 1375°.

Same alloys available in rod form, wire in coils, or rings!

This exclusive Westinghouse Seal "guarantees" you the correct formulation of *every rod!*



Convenient packaging: 18" lengths in 1-lb and 5-lb tubes. Standard 25-lb package, in 36" lengths.

Improved CO-SILVER BRAZING FLUX speeds work on virtually any metal

Cleans! Protects! Directs *fast* capillary action! Melts at low 780°F. Completely stable at 1600°F! Washes clean and bright with hot water! Saves brazing and cleaning time and costs!

YOU CAN BE SURE...IF IT'S **Westinghouse**

TILLMAN
Gloves—Garments

WELDORS
BUY
FROM
YOUR
DEALER

ASK
FOR
OUR
NEW
CATALOG

BRAZILIAN DEERSKIN
THE "STAY SOFT" LEATHER
GLOVES AND MITTENS

TILLMAN PRODUCTS
John Tillman & Co.
Long Beach, Calif.

THREE new transformers increase welding rates, give uniformity in production. (See story below.)

Transformers

DESIGN features on three new transformers include oversize cores for maximum heat dissipation and careful distribution of copper between primary and secondary to minimize losses. Designed for use with "Raytheon" thyratron contactors, the transformers are rated at 1½, 3 and 5 kva. High-production a-c system for welding vacuum tubes, relays, precision instruments and contacts, is set up when transformer is combined with thyratron contactor and welding control. *Raytheon Mfg. Co.*

Circle No. 7

Feed-in duct

TOTALLY enclosed aluminum feed-in ducts require no derating. This feature is accomplished by separating and enclosing the aluminum bus bars in solid sheets of insulating material. Telescoping joints permit infinite adjustability up to 12 in. and eliminate need for special odd lengths. Use of standard 3, 5, 7 and 10-ft straight lengths with one or two telescoping joints gives any dimension needed without special fittings or delivery delays. The duct is available in all standard ratings from 600 to 4,000 amp—two, three and four pole. *Square D Co.*

Circle No. 8

Furnace lens

ENAMEL can be fused to metal and small parts brazed or soldered with Fresnel lens built in solar furnaces. Temperatures from 2,000 to 4,000 F. can be obtained with the clear plastic lens. *Edmund Scientific Co.*

Circle No. 9

Life expectancy determines a GAS CYLINDER'S actual cost

Shrewd buyers choose Harrisburg Seamless Steel cylinders for high pressure gases because they cost less in the long run. Oldest and largest manufacturer of gas cylinders, Harrisburg has, from the beginning, made durability a primary consideration. Based on Harrisburg standards, users traditionally expect a quarter century or more of service from high pressure cylinders.

When you buy cylinders, remember that Harrisburg Cylinders are made with an eye to the future and their ability to pass successive quinquennial tests. This Company manufactures a complete range of sizes and capacities, to I. C. C. specifications, in Export and Domestic types. Send for prices and complete information.

More than a century in Harrisburg

Harrisburg Steel Co.

Division of
HARSCO CORPORATION

Send for literature and prices, specifying with or without caps and valves.

Harrisburg 8, Pennsylvania

Tame your "difficult" steels

with P&H 170 LA Iron-Powder Low-Hydrogen electrodes

For problem steels like high carbon, alloy, high sulfur, free machining, and cold rolled steels, P&H 170 LA is the real answer.

Its low hydrogen content assures welds of superior X-ray quality even in the toughest parent metals.

Its iron-powder coating gives extra fast deposition to speed up operations.

This combination means both high-quality *and* high-speed welds, with improved bead appearance, excellent feathering out, low spatter, and no undercut.

We'll gladly send complete specification data. Write for Bulletin R-29, "P&H Smootharc Welding Electrodes." Dept. 315B, Harnischfeger Corp., Milwaukee 46, Wisconsin.

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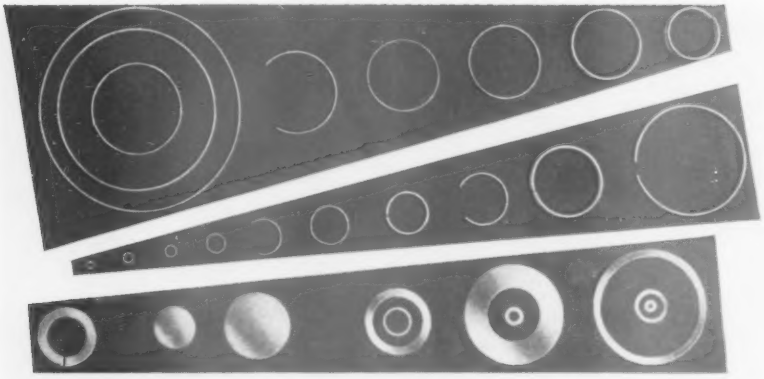

Pre-formed for your needs

GB *PRE-FORMED* Silver Brazing Alloys are available in the size and shape your job requires. Pre-formed shapes, like those shown, are designed for the joint. They assure strong, safe connections with a measured, minimum amount of alloy to save you time and money.

Write today for facts about efficient, economical GB 88 Flux and GB Silver Brazing Alloys in random coils, strip, pre-formed rings or special shapes.

Dealer Distributor Inquiries Invited

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Address_____

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Dial feed welder

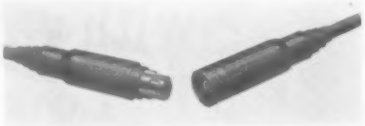
DIAL feed resistance welder joins Monel caps to transistor bases at rate of 1,000 per hour. Welding contact of specialized welder is ring-shaped projection in cap 0.020-in. thick. Operator loads parts continuously. Five fixtures on revolving index table hold parts in position and eject welded assemblies. Welder is 200-kva air-operated single ram projection. *The Taylor-Winfield Corp.*

Circle No. 12

Work table

SELF-contained, two-station work table is designed for hardening, brazing, annealing and soft soldering operations. Standard units have 220/440 3-phase motor generators in ratings from 7½ to 30 kw; output of 220 volts, 10 kc, single-phase; volt, amp, kva and kw meters (rated in percents); lights to show "heat on" and "generator on" and open-sight drain to check cooling waters. Table is 40 in. wide, 56 in. long, 63 in. high with work area of 40 in. *Welduction Corp.*

Circle No. 13



Welding plugs

SINGLE-size connectors can be attached to all cable sizes from #4 through #4/0 AWG. For use in welding cable leads and welding whips. Maximum welding service rating is 550 amps. Feature water-tight Neoprene insulating sleeve, twist-lock connections, low resistant engagement. *Joy Mfg. Co.*

Circle No. 14

FASTER . . . EASIER HARD SURFACING

Semi-Automatically With

Wear O Matic

PRECISION DRAWN HARD SURFACING WIRES

Now you can shorten "down-time" and turn out more resurfaced or rebuilt parts per shift with semi-automatic equipment and Wear-O-Matic precision drawn hard surfacing wires. With deposition rates up to 15 pounds per hour you can easily save up to 50% of the cost of manual hard surfacing operations and yet retain the flexibility of manual welding. In addition, with semi-automatic application there is no stub or coating loss.

Free application manual for automatic and semi-automatic hand surfacing.

Here's why Wear-O-Matic is the RIGHT WIRE for your semi-automatic applications.

More uniform wear resistance Wear-O-Matic wires are compacted to a density almost equal to solid wire resulting in a more uniform hardness and wear resistance throughout the weld deposit.

Continuous smooth feeding The true diameter and dense structure of Wear-O-Matic wire permits smooth feeding without special feed rolls or contact tubes. Wear-O-Matic wires will not crush under standard feed roll pressure.

Find out now how Wear-O-Matic precision drawn wires can improve your hard surfacing operation. Write for free literature and application manual. Drawalloy Corporation, Lincoln Highway West at Alloy Street, York 12, Pennsylvania.

Drawalloy

CORPORATION

YORK 12, PENNSYLVANIA

THE WIRE MILL FOR THE WELDING INDUSTRY — STAINLESS STEEL · HARD SURFACING · TOOL STEEL

Ranite hardsurfacing lays down faster... lasts longer on all construction equipment!

Periodical Ranite hardsurfacing of crusher rolls, mill hammers . . . scraper blades, and all areas that wear out fast insures *longer equipment life . . . saves replacement costs . . . cuts down time.*

Ranite's fast deposition rate and greater metal recovery means that wearing surfaces are built up faster with less hardsurfacing material, in less down time.

You can depend on Ranite's speed . . . Ranite's economy because they are formula-controlled. Pure powdered alloys and the exact amount of flux necessary for instantaneous fusion have been combined for a perfect, balanced formula. This permits 80 per cent metal recovery during hardsurfacing for maximum metal recovery per pound.

Ranite's balanced formula makes possible a deposition rate 20 to 25 per cent faster. It's smoother, too, right down to the butt end. With easy-to-use Ranite, welders can lay down more metal per hour uniformly in any position. It will not chip . . . spall . . . mushroom.

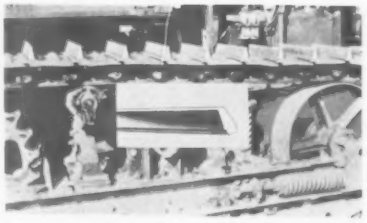
There's a Ranite Hardsurfacing Welding Rod for every type application—from Rockwell C hardness 25 to 68. Send now for free Comparison Chart and complete information on Ranite. Field engineers are also available for consultation on any hardsurfacing problem.

Ranite HARDSURFACING WELDING MATERIALS

ASK YOUR DISTRIBUTOR FOR RANITE!

RANKIN MANUFACTURING CO.

616 S. Marengo Ave., Alhambra, California



Tractor retreads

LINE of tractor grouser retreads for rebuilding grouser shoes of track-laying or crawler-type equipment allows units to be re-lugged without dismantling. "Bulldog tractor grip-lugs," have specially-designed shape, with engineered groove and bevel, that permits faster welding application, according to manufacturer. AWS E-6016 or E-7016 low hydrogen electrodes can be used.

Lugs are made of steel; supplied in 10-ft lengths or available cut-to-length. *Allied Steel & Tractor Products, Inc.*

Circle No. 15

Abrasive belt

COATED abrasive belt is used as cutting tool in "Straight-O-Matic" line of grinding, polishing and deburring machines. For example, the model "R600C-3" unit employs three abrasive belts over one conveyor belt. It is equipped with wet grinding, oil-mist applicator, automatic tracking and pneumatic tensioning of the 10-in. wide abrasive belts. *Curtis Machine Division.*

Circle No. 16

Safety goggles

FLASH goggles with prescription lenses are for wear under welding helmet or hand shield in Mig welding. Obtainable in 10 lens styles—variations of single-vision, bifocal and trifocal types. With side shields, and the lens shade is number two. *Air Reduction Sales Co.*

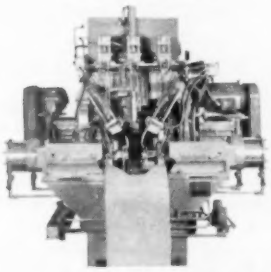
Circle No. 17

Ultrasonic test

ULTRASONIC test equipment can accommodate automatic detection and recording devices. Nondestructive testing units will spot thickness changes in metals and plastics automatically. Can be connected to ring alarm, flash signal light, etc. With this new line of equipment thicknesses down to 0.005 in. can be inspected. Will also indicate lack of bond or gross discontinuities in metal or plastic. *Branson Instruments, Inc.*

Circle No. 18

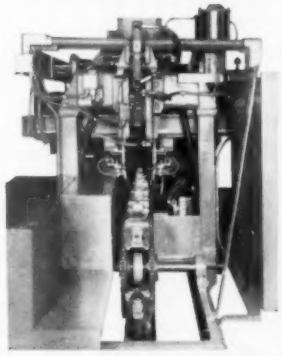
Entry end of line



Federal

PACKAGED PRODUCTION LINE

Automates Pedal Bracket Manufacture for Dodge!



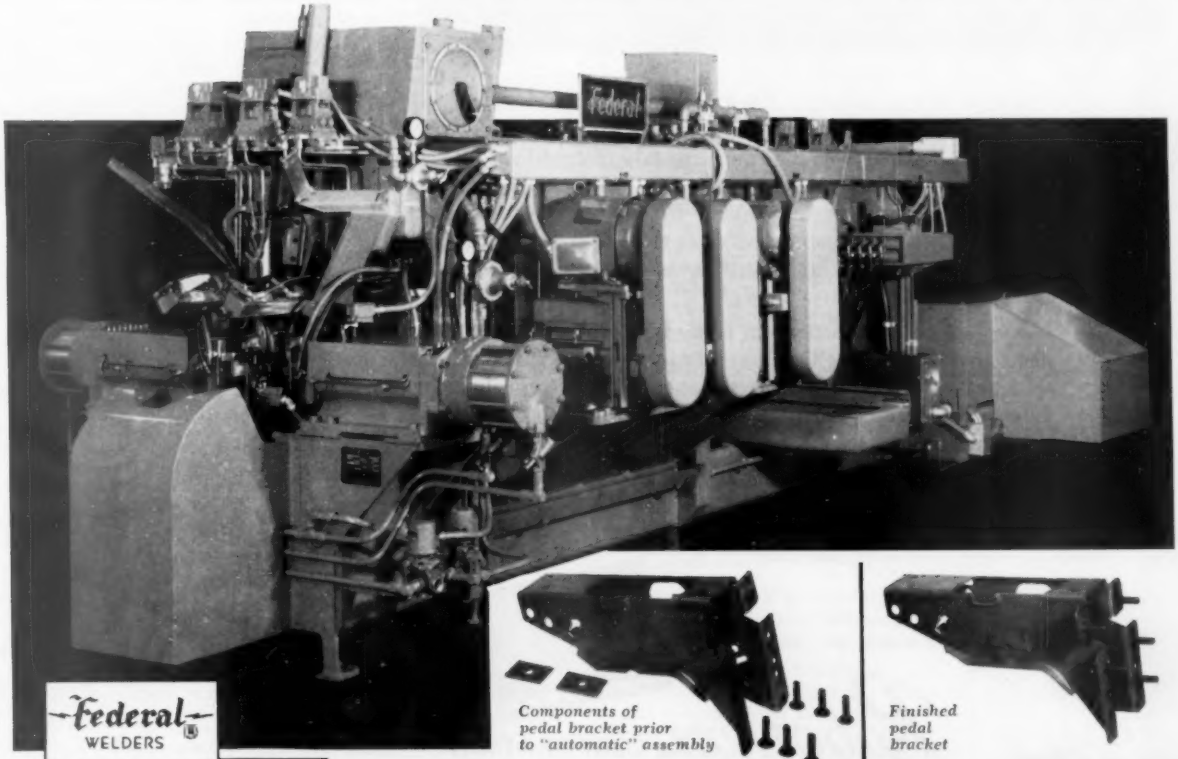
Exit end of line

SINGLE LINE AUTOMATICALLY FEEDS, SPOT FACES, REAMS, DE-BURRS, WELDS TO SPEED PRODUCTION, CONTROL UNIFORMITY OF PEDAL PART

The Dodge Division of the Chrysler Corporation recently set into operation a single Federal machine that performs manufacturing functions normally requiring many separate pieces of equipment. In the fabrication of automotive pedal brackets this Federal "Packaged Production Line" was made to feed and weld two pads to the bracket, spot face one pad, ream and de-burr holes in each pad, feed and weld six mounting bolts and eject the finished piece at a rate of 775 units per hour.

The combining of several manufacturing operations into one has many natural advantages. It means one source responsibility, reduced floor space, and handling requirements, equipment economies and greater product uniformity.

Don't overlook these benefits—talk with Federal—a pioneer in the development and manufacture of "Packaged Production Lines."



Components of pedal bracket prior to "automatic" assembly

Finished pedal bracket

Federal WELDERS®

Warco PRESSES®

The Federal Machine and Welder Company

WARREN, OHIO

225

Faced with the problem of brittleness in high carbon steel welds, this manufacturer called in Robotron for special assistance. Robotron engineers quickly determined the trouble, and recommended the application of an up-down slope control unit to the welder. *Result:* the down slope portion of the unit controlled after-weld heat so that the weld was annealed and brittleness was reduced to a minimum.

Today, practical solutions to *many* welding control problems are found through the correct application of Robotron products—designed by electronic specialists to control the heat, timing and placement of the weld nugget for more efficient precision welding . . . even on hard-to-weld metals.

Let Robotron's experienced staff *team up* with you to solve your control problems. They can help you improve product quality and reduce costs. Call them today.

ELECTRONICS FOR YOU . . . FROM ROBOTRON . . . a new bulletin available upon request

THE FINEST IN INDUSTRIAL ELECTRONICS

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21300 West Eight Mile Road, Detroit 19, Michigan

REPRESENTATIVES IN PRINCIPAL CITIES OF THE U.S. AND CANADA

Coating compound

CORROSION protection to more than 85 sq ft of surface is given by new "Glyptal" coating compound in 16-oz pressure packs. Narrow spray pattern ideal for painting welded joint is furnished by pressure pack application, company maintains. Thin coating dries faster and is easy to apply in corners and difficult angles. A clear synthetic varnish, compound is anti-spatter. Does not have to be removed before welding. Cannot stick to weld. Available in 1, 5 and 55-gal containers. *General Electric Co.*

Circle No. 19

Cut-off machine

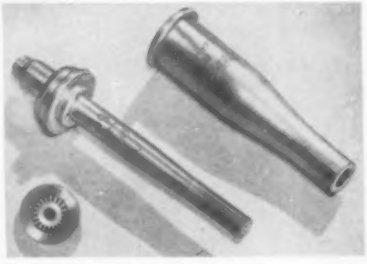
STRAIGHT, tapered and step metal tubes are automatically cut and deburred by cut-off machine. Drilling heads deburr, face and drill any hole size in tubes. Model 3D produces 10,000 or more tapered legs a day. *Continental Machine Co.*

Circle No. 20

Abrasive saw

ABRASIVE saw, termed "Abr-A-Saw," cuts through metal or pipe. Features include compact, lightweight design; foot operated v-wedge hold-down for positive locking of material to be cut; removable chip and dust tray. *Collins Machinery Corp.*

Circle No. 21



Nozzles

Two-piece nozzles are designed for flame-cutting with oxygen and fuel gases. Eash nozzle has from 12 to 20 outlets for pre-heat gases—double the number in conventional models, the manufacturer claims. This feature increases the rate of heat transfer and produces a nearly sold ring of preheat flames. Gases leave cutting nozzle at speed of 1,200 ft per second, increasing cutting speeds. Each 2-piece nozzle has a brass internal section with finely grooved slots for pre-heat gases, and a heat-resistant copper cover. *Linde Co.*

Circle No. 22

Plant, Research Laboratories and World Headquarters

BETTER ORIGINAL FASTER
Low Temperature EUTECTIC WELDING ALLOYS
STRONGER WELDS

EUTECTIC Welding News

PUBLISHED BY EUTECTIC WELDING ALLOYS CORPORATION, 40-40 172 STREET, FLUSHING 58, NEW YORK, N. Y.

"EUTECTIC" WELDING HEADLINES • TIME-MONEY-MACHINERY SAVERS

EUTEC-CHAMFERTRODE REMOVES "FATIGUED" METAL FASTER

By using Eutec-ChamferTrode and Eutec-CutTrode, an Oklahoma hydro-electric plant avoided time-consuming grinding away of "fatigued metal" and accomplished the quick repair of a turbine bucket with great savings in "downtime" and labor.

The bucket, part of a 57-ton turbine, was in danger of cracking because of fatigued metal formation. The bucket's inaccessibility prevented the use of grinding equipment to remove the fatigued metal before welding on stainless steel plates. Eutectic's District Engineer recommended Eutec-ChamferTrode and Eutec-CutTrode, high speed electrodes for gouging, chamfering, and piercing all metals, without the use of oxygen or extensive equipment.

(Fig. A)

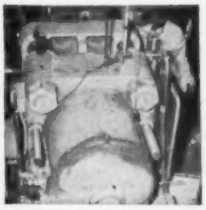
First, the fatigued area was marked off and an outline cut with Eutec-CutTrode. Weldors then gouged out the defective metal with Eutec-ChamferTrode (Fig. A). Gouging was accomplished far more quickly with ChamferTrode than would have been possible with any mechanical grinding equipment. ChamferTrode's special exothermic coating concentrates the force of the arc right at the point of application, producing a highly efficient metal removing tool.

(Fig. B)

Stainless steel plates were then tacked on with EutecTrode 680 AC-DC, an all purpose, high tensile, corrosion resistant electrode for very high alloy and carbon steels. Repair was completed by welding again with EutecTrode 680 AC-DC, which produced a smooth, porosity free weld of perfect density (Fig. B). The weld was deposited at the highest possible speed. Welding was done at lowest possible amperage and no warping occurred. Finished weld has exhibited high strength and wear. *(A-30)*

EUTECTRODE 680 AC-DC WITHSTANDS 1500 PSI

EutecTrode 680 AC-DC has again demonstrated its high tensile strength in repairing the hydraulic compression chamber of an injection molding machine. An eastern manufacturer had tried unsuccessfully to repair the compression chamber, made of cast steel, with conventional high heat welding materials. These welds all cracked under the stress of 1500 psi pressure in the compression chamber.



Before replacing the compression chamber, at a cost of $4200, the manufacturer called in a Eutectic District Engineer. He suggested EutecTrode 680 AC-DC, all purpose, high tensile electrode for very high alloy and carbon steels. Welds of EutecTrode 680 AC-DC were deposited at high speed and at lowest possible amperage settings. The manufacturer discovered that EutecTrode 680 AC-DC gave a smoother, denser weld, free from porosities and undercutting. In operation, the weld has combined high tensile strength with sufficient elongation to absorb compression chamber stress without cracking. The ultimate tensile strength of EutecTrode 680 AC-DC is 120,000 psi. *(A-33)*

CAST IRON WELD SAVES $6,000, FOUR MONTHS "DOWNTIME"

By using EutecRod 1804 to repair a 50 HP motor which had eight cracked fins at the end of its armature, a New England aircraft plant saved $6000. This was the cost for removing the motor from the plant, repairing it, and re-installing it.

Company officials consulted Eutectic's District Engineer. He suggested repair with EutecRod 1804, a copper base, silver bearing, thin flowing alloy that produces high strength joints on close fitting operations. Using 15 lbs of EutecRod 1804, a weldor repaired the armature fins in less than six hours. Welds have shown excellent wear and conductivity. EutecRod 1804 does not require fusion of the base metal; its ultimate tensile strength is up to 50,000 psi. *(A-34)*

WELDING MACHINE BASE WITHOUT DISMANTLING SAVES $3200

Use of Eutec-ChamferTrode and Eutectic "Low Temperature Welding Alloys" to repair the heavy base casting on a planer without dismantling it from the planer saved an Idaho lumber company $3200 and four months "downtime." To replace the base casting, which cost $1200, the entire planer would have to be shipped to its East Coast manufacturer. This would have cost $2000 in railroad fares and kept the planer out of production for four months.

Eutec-ChamferTrode was used to give a right angle chamfer to all broken edges on the casting. The weldor then applied a dense, smooth weld of EutecTrode 27, a high strength, ferrous electrode for all cast iron repairs where machinability is not desired. The base casting was re-welded with Xyron 2-24, which permits "cold" cast iron welding from all positions without dismantling heavy sections. Xyron 2-24's "Frigid Arc" coating produced a dense, machinable weld, free from cracks and stress formations. Weldors have found that Xyron 2-24 gives very close color match and permits great ease of application. *(A-31)*

EUTECROD 16FC LOWERS FINISHING COSTS

Warping and uneven welds caused by conventional high heat welding materials led a manufacturer of calculating machine carriage shells to try EutecRod 16FC, a

highest strength, "brazing type" alloy for joining steel and other metals. Precision standards for the carriage shells made warped parts unacceptable. Further finishing of uneven welds was an added cost to the manufacturer.

Use of EutecRod 16FC has resulted in lowered finishing costs and stronger welds. Great capillarity of EutecRod 16FC makes it ideal for thin forming operation required in welding carriage shells. EutecRod16FC produces a smooth, porosity free weld requiring no further extensive finishing. It is applied at the lowest possible temperature without fusion of the base metal. No warping occurs. Ultimate tensile strength is up to 100,000 psi. *(A-32)*

Eutectic Welding Alloys Corporation
40-40 172nd Street, Flushing 58, N.Y.

Gentlemen:

I would like further free information on the following:

☐ A-30 ☐ A-31 ☐ A-32
☐ A-33 ☐ A-34
☐ **Free 170 page pocket Welding Data Book.**

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Address_____

City_____ State_____

LEASING

CYLINDERS & EQUIPMENT

will release working capital, improve balance sheet, provide important tax savings

LONG TERM LEASES ON . . .

High pressure and acetylene cylinders, trailers, liquid oxygen vessels . . .

. . . AND ALL TYPES OF EQUIPMENT, INCLUDING:

Arc and Resistance Welding, positioning and materials handling, oxy-acetylene cutting, X-Ray inspection, complete plants.

INQUIRIES WELCOME FROM MANUFACTURERS, DISTRIBUTORS AND USERS. WRITE TO . . .

LIBERTY LEASING CORPORATION

341 Madison Ave., New York 17

Capacitor

Low inductance capacitor for energy storage banks is ideal in high-frequency pulse circuits where optimum rise time is essential, manufacturer says. Has applications in stored-energy resistance welders. Rated at 100 kilovolts, .25 microfarads, has ringing frequency of 2.5 megacycles. *General Electric Co.*

Circle No. 23

Clamp assembly

Operating with either left or right hand swing by optional location of stock to be worked, new revolving clamp assembly is used to hold down work to be drilled or milled. Assembly incorporates a detachable, spring lock revolving shoe on a knob screw for use when uneven clamp down is unavoidable. Clamp assembly is made of malleable casting designed to swing clear of work and fixture. Available in 3 sizes, 1½ in., 3 in., and 4 in., each assembly can be applied by drilling and tapping one hole. *Jergens Tool Specialty Co.*

Circle No. 24

Gas regulators

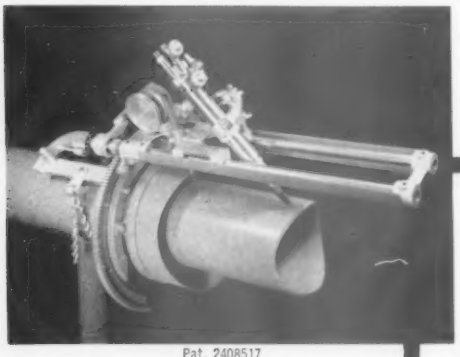
Series of regulators for compressed gases is being developed to combine economy and simplicity with rugged performance, manufacturer reports. For medium-to-light industrial applications. Slated for release in August. *K-G Equipment Co.*

Circle No. 25

Glasses

Weldors who wear glasses can have individual prescription lenses inserted in new "Magna-Lens" frame to make close visual work easier. Lenses are placed in the weldor's helmet along with cover plate and welding plate. Available only on prescription from optometrist. *Magna Co.*

Circle No. 26



Pat. 2408517

SHAPE CUTTER

Patent Applied For

OUT•OF•ROUND

Torch control

FOR PERFECT CUTS AND BEVELS

For improved control of accuracy and precision in pipe cutting and beveling, H & M now offers the *new and improved* Out-of-Round Attachment — plus the H & M Shape Cutter.

The new Out-of-Round features greater accuracy, simplicity and ease of operation in cutting pipe, where the circumference of the pipe is of imperfect shape.

The Shape Cutter makes the most complex intersectional cuts precise and accurate by using a proven pattern or templet.

In both cases, the torch is forced to follow a predetermined course that you *know* is perfect.

Both the Out-of-Round and the Shape Cutter are available in sizes to fit any of the standard H & M Pipe Cutting and Beveling Machines. Illustrated bulletins are yours upon request.

H&M

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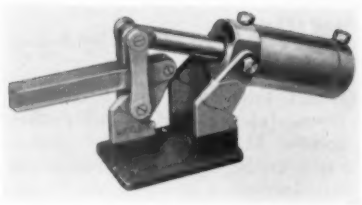
PIPE BEVELING MACHINE CO.

311 EAST THIRD ST. Diamond 3-0241

TULSA, OKLAHOMA



Toggle Clamp

GIANT toggle-clamp weighs 16 lb, has overall length of 15⅞ in. (closed), height of 7¼ in. and delivers holding pressures up to 2,000 lb with normal airline pressure of 90 lb.

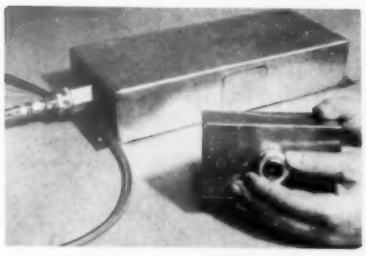
Both clamp and mounting base equipped with hardened bushings and pivot rods. Clamp expectancy is at least 400,000 cycles, manufacturer claims. All components of model 858 individually replaceable. *Finished Products Div., Detroit Stamping Co.*

Circle No. 27

Metal polishing

DRUMS ranging from 37-74 in. are for sanding or polishing wide metal sheets. Series of fiber brushes, spaced around drum circumference, back-up series of abrasive strips that feed out from inside the drum and wipe the abrasive against the stock. Such action achieves uniform scratch pattern. New abrasive is fed out of drum as required. *Merit Products.*

Circle No. 28



Transducers

CLEANING areas up to 84 sq in. available in new line of transducers which permit use of ultrasonic equipment with all types of active detergents, solvents, alkaline cleaners and even some mild acids. Because the housings of type AISI 316L stainless steel have arc-welded joints, the resulting transducers are leak-proof and corrosion-resistant.

Two types are available: "B" series, fitted with Teflon-gasketed bulkhead mounting so electrical connection with cable from ultrasonic generator is made outside cleaning tank, and "E" series which are immersible in cleaning fluid. *Branson Ultrasonic Corp.*

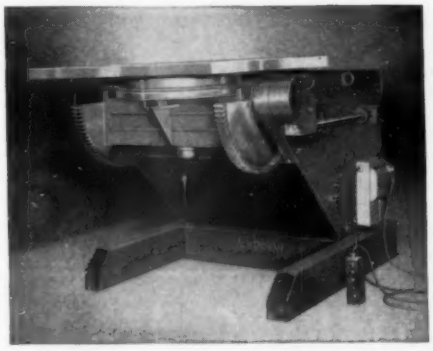
Circle No. 29

Aronson

HEAVY DUTY GEAR DRIVEN POSITIONERS...

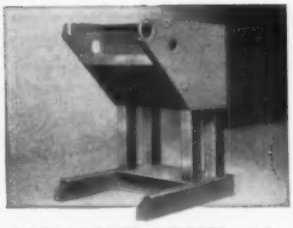
Have BACKBONE

HD Models of ARONSON WELDING POSITIONERS feature the basic BOX TYPE CONSTRUCTION with its advantage of extreme RIGIDITY — Holds your weldments *Steadier* and *Safer* — Affords Protection of Motors and Controls which are mounted *inside* the Box Chassis, out of harm's way — and provides WORKING PLATFORM area on the *flat* steel top.



No Other Type Construction can afford the Rigidity and Strength, and provide the Necessary Backbone for the mechanism that guarantees the user of an ARONSON POSITIONER the Fastest, Highest Precision Welds, and with Complete Safety.

With Table in the Flat Position and with Table Height at Minimum Setting, there is *nothing projecting* above the top of the chassis to limit the diameter of work you can swing, *no column* to get in the way, nothing for the weldment to smash into!



4-POST ADJUSTABLE BASE carries out the advantages of the Box Design, affording maximum effective Column of Support *many times stronger and more rigid than any single post design.*

POSITIONEERING with Aronson

POSITIONERS

UNIVERSAL BALANCE® POSITIONERS
BENCH TURNTABLE POSITIONERS
GEAR DRIVEN POSITIONERS
HEADSTOCK-TAILSTOCK POSITIONERS
TRACTRED® TURNING ROLLS
RUBBER-TIRED TURNING ROLLS
RAIL CAR POSITIONERS • TURNTABLES
FULLY AUTOMATIC POSITIONERS
MAGNETIC WELDING CLAMPS

ARONSON offers you over 200 PROVEN Standard Stock Models of Quality POSITIONERS "POSITIONEERED" to your exact requirements

Write for detailed engineering data

Quality POSITIONERS by Aronson MACHINE COMPANY
ARCADE, NEW YORK

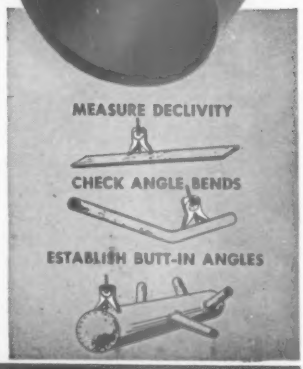
DIAL SET LEVEL _____

MARK A CENTER LINE
at any angle

DIAL SET 45°

TO ESTABLISH AND MARK a point at any degree of angle on shaft, pipe or tube without numerous calculations or "cut and try" methods use the Boyce Centering Head. It's a must for welders, machinists, pipe fitters and boilermakers because it is *absolutely accurate* and saves time. Small enough to fit in your pocket, it weighs only 9 ounces. Order yours today or write for information.

CONTOUR MARKER CORP.
1843 E. Compton Boulevard, Compton, California



Boyce CENTERING HEAD

WELDERS PREFER IT...

...IT'S SPECIALLY DESIGNED for 3-WAY SUPERIORITY

- 30% more heat resistance than any other make—wrap around glass fibre tip insulation.
- Body completely insulated, there are no bare spots.
- Red Tips and Trigger... bright Yellow Handle... an outstanding safety feature ... quickly identifies Hi-Amp Holders.

ELECTRODE HOLDERS
TWO WAYS MORE ECONOMICAL, TOO

OTHER WELDING ACCESSORIES

HI-AMP

SEE YOUR WELDING SUPPLY DEALER

LENCO INCORPORATED
JACKSON, MISSOURI

NEWS . . . . . *from page 6*

stated. It is used in scavenging of gases, from metals in alloy manufacture, in preparing new chemical fuels for the supersonic bombers and missiles, etc.

Due to its low density, lithium is exceptionally promising as a coolant for aircraft nuclear propulsion plants.

Westinghouse to build new transformer plant

Westinghouse Electric Corp., Pittsburgh, plans to build a distribution transformer plant in Athens, Ga. The new plant will be part of the transformer division headquartered in Sharon, Pa.

The new building will be a one-story structure containing 750,000 sq ft. Production is scheduled to begin in 1958. Gordon C. Hulbert has been named plant manager.

For rent: ultrasonics

Ultrasonic systems and equipment are now available to industry on a rental basis.

The new approach to ultrasonic equipment marketing has been announced by Gulton Industries, Inc., Metuchen, N. J., which said there will be no exploitation of the company's patent position because the purchaser can either rent or buy the equipment.

The three-phased equipment program includes: purchase with RETMA guarantees, purchase with Gulton service and maintenance contract or monthly rental with all service maintenance.

Hammer Tool expands again

In its third plant expansion since 1945, Hammer Blow Tool Co., Wausau, Wis., added a new steel addition. Factory space is now 20,000 sq ft.

The company manufactures farm implements and axle assemblies, couplers and jacks for mobile home industry.

Porter to erect 17-story building

H. K. Porter Co., Inc., New York City, plans to construct a 17-story office building at 6th Ave. and Grant St., in Pittsburgh. The general offices of Porter will occupy approximately six floors of the proposed structure, with the balance to be occupied by other tenants.

NSC offers word to wise

Good housekeeping is essential in the soldering industry, the National Safety Council warns.

It points out that hand soldering and brazing—among the most common industrial operations—present hidden hazards.

Soldering and brazing can lead to burns, dermatitis, lead poisoning, fire and irritation from fluxes. The best deterrant is good working conditions and proper practices.

Greatest danger in solders are from cadmium, zinc, antimony and fluorides. Good housekeeping includes keeping lunches apart from toxic materials and being careful not to breathe fumes.

ASTM elects new officers

Official announcement of new officers of the American Society for Testing Materials was given at its 60th annual meeting in Atlantic City June 16-21.

Richard T. Kropf is president and F. L. LaQue is vice president.

MISS Weldor of 1957 is Monique Van Vooren, Eutectic Welding Alloys Corporation bestowed the title on the comely star of stage, screen and television.

Just You TRY to Break a

THERMO Spiral TIP CLEANER

The exclusive, non-breakable advantage of THERMO TIP cleaners didn't just happen—No Sir! This feature resulted after 10 years research, and experience. That's why we say no other type or make can match a THERMO; and the best way to prove that statement is to send for a FREE THERMO Spiral Tip Cleaner and put it to every test—as to its cleaning efficiency and long lasting performances. Yes, just TRY to break it—then you'll know why—

All Progressive Welding Supply Dealers Recommend THERMO TIP CLEANERS

THERMACOTE Company

108 S. DeLacy Avenue, Pasadena, California

get more efficient production
LONGER
Rebuild worn Gyratory, Roll and Jaw Crushers with
MANGANAL
T.M. Reg. U.S. Pat. Off.
11% - 13½%
MANGANESE - NICKEL STEEL
ROUND APPLICATOR BARS
Beats the high cost of replacements, downtime and maintenance. Crushers can be reclaimed over and over again.
MEMBER
NATIONAL WELDING SUPPLY ASSOCIATION
SOLE PRODUCER
Write for Complete Details and Price List
STULZ-SICKLES CO.
PORT AVE. at JULIA ST. • ELIZABETH, N. J.
NEAREST DISTRIBUTOR on REQUEST

"WE CUT REWORKS 94% With Dry Rod Electrode Oven!"

Type 300 Dry-Rod Oven

WHEN 1 out of 3 welded hydraulic fittings were rejected by a leading Milwaukee machinery plant*, engineers blamed *moist electrodes.* Installing a low-cost Dry-Rod Electrode Oven to store all unpackaged low-hydrogen rods, this company got immediate improvement . . . faster, better welds . . . few rejects. Reworks were cut from 30 pieces to less than 2 per hundred.

Type 10 Portable Dry-Rod

DRY-ROD Ovens insure against defective welds caused by moisture, protect low-hydrogen, austenitic, special alloy electrodes, and iron powder contact rods. Completely wired, ready to use. 3 sizes available, for all industrial needs.

See Your Welding Supply Dealer

*Name upon request

Dry-Rod *Division of* **PHOENIX PRODUCTS CO.**

X-DR-23 4715 N. 27th St.—Milwaukee 9, Wis.

Alloys and Fluxes for joining ALL METALS ALL METHODS
TORCH WELDING
SOLDERING • FILLING • SEALING
TORCH BRAZING
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WEAR PROBLEM . . . INSIDE OR OUTSIDE. ONE SOLUTION!

ALL-STATE NO. 13 NICKEL SILVER BUILDUP ROD

ALL-STATE Alloys and Fluxes

for welding • brazing • soldering • tinning • cutting

Users Report on Cams: "Using your No. 13 rod to build up such surfaces, we have had 3 to 5 times the cam life."

Users Report on Wrist Pin Holes in 500-lb. Pistons: "No. 13 enabled successful repair where 200 degrees more heat would have spoiled everything. There was no warpage."

For Instruction Book on 62 alloys and fluxes write *All-State Welding Alloys Co., Inc. White Plains, N. Y.*

ALL-STATE ALLOYS AND FLUXES

REQUEST COMPLETE LIST OF THESE PRODUCTS FOR PROBLEM SOLUTIONS

COMING EVENTS

JUNE 28-JULY 14: Chicagoland Fair, Chicago Association of Commerce & Industry, Navy Pier, Chicago.

JUNE 29-JULY 6: Annual Assembly, International Institute of Welding, Essen, Germany.

JULY 1-3: Summer Meeting, Independent Oxygen Manufacturers' Association, Broadmoor Hotel, Colorado Springs, Colo.

OCT. 7-9: National Electronics Conference, co-sponsor Illinois Institute of Technology, Hotel Sherman, Chicago.

OCT. 21-25: National Safety Congress, Chicago.

OCT. 27-NOV. 1: Fourth Annual conference, Atomic Industrial Forum, Second Fall meeting, American Nuclear Society, and Trade Fair of Atomic Industry, Coliseum, New York City.

NOV. 4-8: Thirty-ninth National Metal Exposition & Congress, concurrently with Second World Metallurgical Congress, American Society for Metals, International Amphitheatre, Chicago.

Metals conference in Jacksonville

Top U. S. metallurgists gathered in Jacksonville, Fla., recently for a three-day Southern Metals Conference sponsored by the American Society for Metals.

Latest techniques in testing and inspecting metals under strain and heat were discussed. ASM president, Dr. Donald S. Clark, stated that one of the most challenging aspects of metallurgy today is the quest for alloys to withstand the tremendous heat generated by atomic-age technological developments.

Specialists gave talks on developments in non-destructive metal testing techniques, tubing for nuclear reactors, and reactor coolants.

About 150 delegates attended the conference in the George Washington Hotel. The Jacksonville chapter was host.

ASM releases home study courses

Four home study courses of the new Metals Engineering Institute of American Society for Metals, Cleveland, are ready for distribution.

The first four courses cover elements of metallurgy, heat treatment of steel, titanium, high temperature metals. More information is available from ASM Metals Engineering Institute, 7301 Euclid Ave., Cleveland 3.

Selas forms export division

Selas Corp. of America, Dresher, Pa., has formed an export division. Immediate objective is to service the company's recently created European division and to act as liaison between it and main headquarters. James S. Shute has been named manager.

Offer film on compressed air

"Overworked and underpowered" is the title of a new 23-minute, 16mm sound-color educational film available from the Compressed Air & Gas Institute, 14000 Terminal Tower, Cleveland. The film shows how to make savings in use of compressed air and how to re-evaluate the air system in a user's plant. Other films on compressed air are also available.

Buffalo is scene of sales meeting

Sales representatives from over the country will gather in Buffalo to attend the 37th annual sales convention of Electro Refractories and Abrasives Corp.

The grinding wheel division will take over July 15-16, and July 22-23 the refractories division will convene. Talks by company experts will fill the first day, and the second will feature informal discussions.

Ryan Aircraft expands with industry

Keeping up with rapidly expanding military and commercial production rates, Ryan Aeronautical Co. has opened a new plant in Los Angeles. The 27-acre site is adjacent to Torrence Municipal Airport.

Of heavy structural-steel high-bay, broad-span construction, the new plant is used for assembly operations on such projects as the Douglas DC-8 commercial jet airliner power packages and pylons, and the Ryan Firebee jet drone missile.

All fabrication work is done in Ryan's San Diego plant.

Distibutor appointments

Adams Carbide Corp., Kenilworth, N. J.: Erie Industrial Supply Co., Erie, Pa.

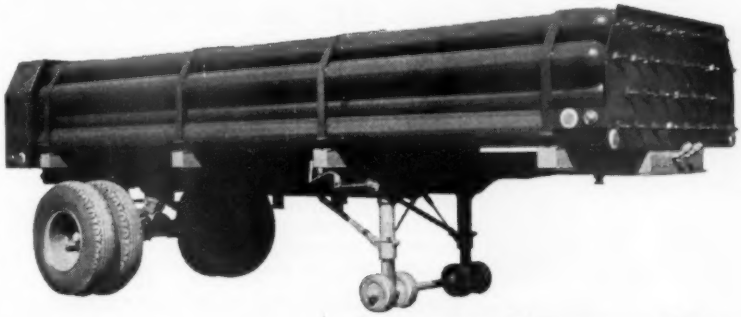
Electro Refractories & Abrasives Co., Buffalo: Rex Tool Co., Inc., Milwaukee.

Smith Welding Equipment Corp., Minneapolis: Wesco Corp., Charleston, W. Va.; Chartres Supply Co., New Orleans; Lund Oxygen Co. Inc., Shreveport, La.

REDUCE CYLINDER HANDLING up to 50%

with INDEPENDENT *Gas Supply TRAILERS*

TRANSPORTING — Argon — Carbon Dioxide — Helium—Nitrogen— Oxygen — Boron Trifluroide — Hydrogen — Ethylene. Trailer capacities from 187,000 cu. in. to 750,000 cu. in. water capacity. Trailer tubes ICC3A-2400 Specifications with 2400 PSIG Working Pressure.



Sizes and weights to meet all State requirements.

Can be mounted on bases for permanent storage.

INDEPENDENT ENGINEERING CO., Inc.

CONSULTING · RESEARCH · DESIGNING

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AT THE FRONTIERS OF PROGRESS YOU'LL FIND

AN AIR REDUCTION PRODUCT

FOR WELDING AND CUTTING...

IN THE RED DRUM

HIGHEST QUALITY

DUST-FREE

NATIONAL CARBIDE

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

National Carbide Company

GENERAL OFFICES: 150 East 42ND STREET, NEW YORK 17, N. Y.

A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED

LAY OUT PIPE JOINTS
in minutes!
SAVE TIME AND MONEY!
A SMOOTH SWING of the Contour Marker's soapstone point and you're ready to cut! It's easy and absolutely accurate because there is an angle dial calibrated in both degrees and pitch. Any of the pipe joint angles shown can be marked off in minutes. And you save "man hours" as well as oxygen and acetylene gas because "cut and try" methods are completely eliminated. Two sizes are available complete with adapter for marking structural steel. Standard, for pipes from 1½" to 18" dia.; Jumbo, for pipes from 16" to 48" dia. Instruction book included. Belt case available. Write for information
CONTOUR MARKER CORPORATION OF CALIFORNIA
1843 E. Compton Blvd., Compton, California • NEwmark 1-9474
THE CONTOUR MARKER

TFC
ORNAMENTAL IRON
CASTINGS
MORE THAN 400 DESIGNS for making up ornamental iron grille work, columns, rails. A design for every style of architecture. Complete range of standard sizes.
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Please send 32-page catalog: "Everything for the Ornamental Iron Shop."
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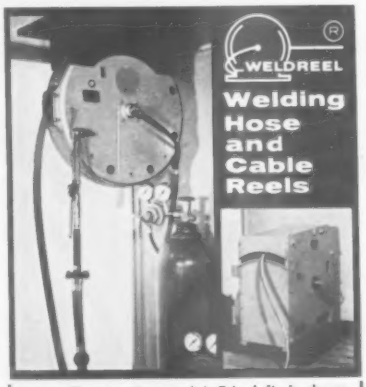


The popular model OA, left, is shown mounted on ceiling. The model OAB, right, has large reel capacity.

Keep hose and cable off the floor when not in use—increase plant safety. Greatly extend hose and cable life—save on replacement cost.

Hose or cable is paid out freely from a WELDREEL Unit and locks at any desired length. A slight tug releases the locking pawl and a spring rewinds hose or cable onto reel.

Available in Models to hold from 40' to 150' of double hose, 50' of single hose, or 100' of cable.

Write for complete information.

UNITED SPECIALTIES, INC.
P. O. BOX 698 EL DORADO, ARKANSAS

Muller

Grotevent

Dr. Albert Muller has been named assistant to the president of Air Reduction Sales Co. He will help President J. H. Humberstone to choose and develop new products and processes. Until recently Muller was director of metallurgical research at the company's research laboratory. *W. F. Grotevent* has been appointed works manager of Air Reduction's new Chicago liquid plant. He was plant superintendent of Airco's Riverton, N. J., liquid-oxygen plant.

J. J. Staudinger has been named assistant regional distribution manager for central region of Pure Carbonic Co. He will headquarter in Cleveland. His former post as Pureco warehouse manager at Detroit has been filled by *J. W. Harr*. *T. J. Rochford* succeeds Harr as warehouse manager at Cleveland.

A. T. (Mort) Mortrud is manager of the arc welding division of Burdett Oxygen Co., Cleveland.

Burdett Oxygen Co., Cleveland, Ohio, has appointed *A. T. (Mort) Mortrud* manager of the arc welding division. He will supervise sales of General Electric arc welding machines, electrodes and accessories.

C. R. Rigby, former manager of A. O. Smith's Houston works, has joined the company's central manufacturing staff in Milwaukee.

New sales appointments by Wheelabrator Corp. are as follows: *Kenneth E. Blessing* named sales manager of dust and fume control division; *Lawrence W. Kohlmeyer* appointed district manager of the New York City office, replacing Mr. Blessing; *George F. Jones* named district sales engineer at the Chicago office, replacing Mr. Kohlmeyer.

Speed-Up WELDING
WITH SUPERIOR'S BENCH MODEL
POSITIONER-TURNTABLE

Complete with Foot-Control Switch

Weighs 20 Lbs.

LOW PRICE • HIGH QUALITY

Holds work in any position from vertical to horizontal and will carry 100-pound load.

Smooth, stepless speed change, both forward and reverse, from zero to 6 rpm—greater speed if desired. Ideal for aircraft work.

Reduces rejects—increases output up to 25%. Gear driven motor, v-belt transmission with tension control, built-in ground for more uniform welds.

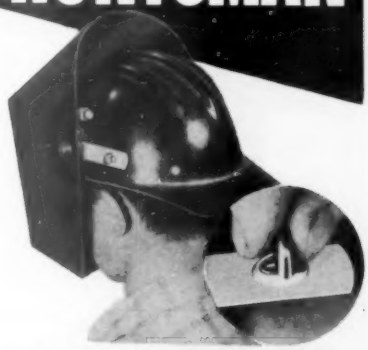
Good Distributor territories still open. Write for details

For additional information, write or wire to:

SUPERIOR WELDING CO.
3410 E. 14th St., Los Angeles 23, Calif.

GET FULL HEAD PROTECTION 100% of the time

HUNTSMAN



New Combination Hard-Cap Welding Helmet

NOW with new

ROTO-CLIP

permits you to detach or attach helmet without removing Hard-Cap from your head. ORDER TODAY!

KEDMAN CO., 233 South 5th West
Salt Lake City 1, Utah

Dr. E. M. Kipp has joined Foote Mineral Co. as director of research. He will direct the activities of Foote's research and development department at Berwyn, Pa. He had been affiliated with Aluminum Co. of America in various research capacities since 1939.

J. Roy Gordon has been elected executive vice president of The International Nickel Co. of Canada, Ltd., and also of The International Nickel Co., Inc., New York City.

NEW district manager of Sight Feed Generator Co., W. Alexandria, O., is A. A. (Gus) Osborne. He will serve northeastern United States.

Franklin P. Hinman has been appointed operations manager of the cathode ray and power tube departments of Westinghouse Electric Corp., electronic tube division, Elmira, N. Y. *George C. Sziklai* has been named technical assistant to R. T. Orth, vice president and general manager of the division.

John W. Moeller has been appointed sales manager of the Welding Products Division of California Alloy Products Co., Los Angeles. He had been manager of the Welding Division of Pacific Metal Co.

Four new sales engineers were recently appointed by Erico Products, Inc., Cleveland. They are *Jack Loftus*, for Southern New Jersey and Eastern Pennsylvania; *Jim Poss*, for Eastern Ohio and Western Pennsylvania; *Tom Balch*, for Southern Texas, Arkansas and Louisiana; and *Dick Tyska*, for Southern Illinois, Kansas and Missouri.

Died . . .

Harry T. Paterson, 46, operational manager of International Nickel's corrosion test stations, died suddenly at his home in Wilmington, N. C., May 27. Mr. Paterson had been with the firm since 1946.

Lee H. DeWald, 51, chief metallurgist for National Cylinder Gas Co., died May 30 at his home in Aurora, Ill. Mr. DeWald worked for NCG at their 19th St. plant in Cicero.

Weld-O-Vent

"World's Finest Exhaust Systems"

Welding Fume Exhausters

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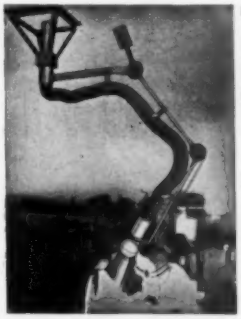

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- Portable and stationary units for all applications.
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Made Easy With
"Visuweld" Torches

VISUWELD torches improve and simplify tig welding by giving faster and better welds with less effort and minimum torch maintenance.

- The lightest and smallest 350 amp TIG welding torch with super maneuverability.
- Only TIG torch made with standard size transparent cup that guarantees absolute welding visibility.
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- VISUWELD contained unit torch head guarantees no water or gas leakage, and the coolest TIG welding torch ever designed.

Perfect welds at welding ranges from 3 to 350 Amps eliminates the need for 'standby' torches. VISUWELD torches are 3 torches in 1.

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HEATING UNITS

BRAZING
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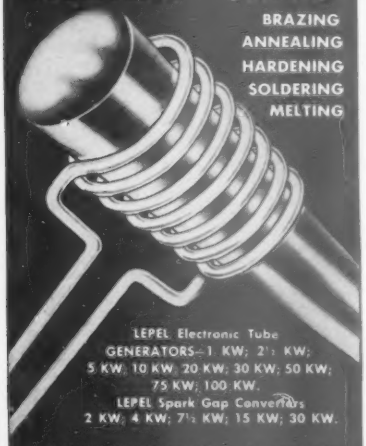

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30 YEARS AGO

(Taken from *The Welding Engineer* of July, 1927)

"This Blue rod has put into welding the same lift that the blue notes have put into jazz," a Lincoln Welder advertisement claims about its new welding rod.

— 30 YEARS AGO —

For pioneer work in the acetylene industry, Augustine Davis and Edmond Fouche received Morehead Medals from the International Acetylene Association.

— 30 YEARS AGO —

John Aubel Kratz, chief of the Rehabilitation Division, Federal Board of Vocational Education in Washington, D. C., says, "In business as in industry, work is either so highly distributed that little or no initial training is required of the worker, or so highly specialized that pre-training is required."

— 30 YEARS AGO —

Combining business with pleasure, the Compressed Gas Mfg. Association held their summer outing at the Seaview Golf Club, Absecon, N. J.

— 30 YEARS AGO —

In the new products line, Mattice Engineering Co., Philadelphia, has a new electrode holder said to be sturdy and strong, yet simple in construction. It has a lightning release handle.

— 30 YEARS AGO —

An editorial notes that "considering the extreme youth of the welding industry, it is showing very encouraging signs of thriving under the influence of good habits."

— 30 YEARS AGO —

In a record 31 days from the signing of the contract, Semet-Solvay Engineering Corp. completed the construction of a complete Steere water gas machine for Wisconsin Gas and Electric Co., Waukesha, Wis.

— 30 YEARS AGO —

An arc-welded spark plug has appeared in the automobile industry, an article notes. In the past the plugs were made by assembling the outer steel shell around the porcelain core in two halves and threading the halves together.

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No. 1 WELDING FLUX

Acts as a cleansing agent—removes all impurities in the metal at the weld—prevents formation of oxide—eliminates blow holes—makes possible a better granular, softer, more ductile structure in the weld. Starts melting at 1150°—completes: 1275°.

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13—Brazing Flux for Extruded Bronzes
14—Special Brazing Flux for Aluminum Bronze, Everdur, and all Silicon Bronzes
15—Special Flux for Magnesium Alloys, Dow Metal, etc.
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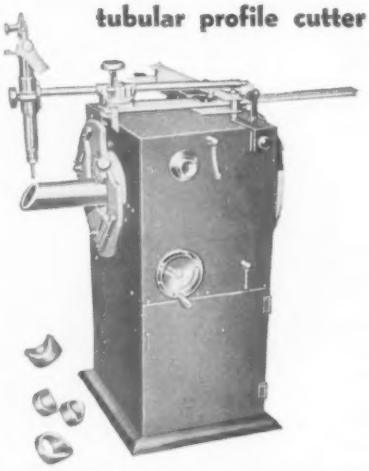

It's versatile! You can make all types of precision flame cuts on pipe or tubing with this machine, angles, miters, saddles, bevels, spiral slots, notches, cams, serrations, and many different shapes or profiles.

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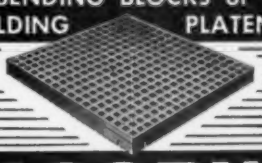

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ELECTRODE HOLDERS.
RALL SUPPLY CO. 51 E. 42nd St., N.Y.C. 17

free literature . . . . . USE CARD ON PAGE 91

51. OPTICAL AIDS—Edmund Scientific Co. More than 1,000 optical items listed in 72-page catalog on optical aids. Includes data on all types of optical instruments.

52. POWER CABLES—Walker Bros. Leaflets PPC-454 describes firm's portable power cables; gives specifications and data.

53. HELMET ADJUSTMENT—Kedman Co. Bulletin on "Roto-Clip" for Huntsman line of welding helmets. Makes helmet shell and hardcap interchangeable.

54. INDUCTION HEATING—Induction Heating Corp. Booklet No. IHN-8 discusses internal heating, brazing, hardening, annealing.

55. SPOT WELDER—Guthery Machine Tool Corp. Colored folder describes spot welding guns P281 and P293. Models have built-in transformer, wide range of electrode set-ups, one-hand operation.

56. SCREWDRIVER—Kedman Co. World's handiest screwdriver, literature says. Holds, starts and drives the screw. Leaflet gives details.

57. COUNTER DISPLAYS—Kedman Co. Displays help sell new screw-holding screwdriver. Literature gives sizes, varieties.

58. FACE SHIELD—American Optical Co. Brochure describes face shield windows with permanent curvature. Fit inside radius of spark deflector.

59. WELDING HOSE—H. K. Porter Co., Inc. Colorful page details "Tu-Line" welding hose. Flame resistant, lines bonded together, safe.

60. SPEED BELTS—Worthington Corp. Bulletin #1640-B1 P offers information on features of variable speed belts.

61. WELDING MACHINES—Expert Die & Tool Co., Inc. 4-page folder (Expert Automation vol 1, no. 1) includes three designs and applications of automated welding and automation machines and how they solve problems.

62. METAL TREATMENT—E. F. Houghton & Co. 84-page booklet describes developments in surface treatment of metals. Covers rust prevention, mechanical and chemical cleaning, blackening, etc. Treatment processes diagrammed.

63. TESTING MACHINE—Steel City Testing Machines, Inc. Page form D-856 provides data on new testing machine, "Model D Ductility." Especially for users of thin gauges of sheet metal.

64. VALVES—Mirenda Corp. Illustrated sheet treats valves, fittings, pumps. Latest in strength and chemical resistance to corrosion, makers says.

65. HEAT TREATING—Aluminum & Architectural Metals Co. Catalog lists heat treating accessories: retorts, coil, skeleton baskets, carburizing boxes.

66. SPOT WELDER—Guthery Machine Tool Corp. Portable "Twin spot" welder type DP 45 described in leaflet. Includes information on timing unit.

67. WELDER—Automatic Welding Co. Big production welder fully pictured and discussed in leaflet. Engineered for high speed precision welding.

68. COMPOUND—Linde Co. Nozzle compound stops spatter pick-up, cuts downtime, small book claims.

69. ARC WELDING—Lenco, Inc. Book explains "HI-Amp" electrode holders, ground clamps and welding accessories (marking pencil, cable connectors, special ground attachments for rotating work, etc.).

70. WELDING CONTROL — Pandjiris Weldment Co. Catalog No. 8155 gives details on welding equipment, direction welding head control, manipulator.

71. MOTORS—Allis-Chalmers Mfg. Co. Cleverly cartooned book explains "how to make a motor go . . . and go and go."

72. LITHIUM—American Lithium Institute, Inc. 15-page tabbed brochure describes properties, uses, research potentials and availability of lithium and its unique compounds.

73. CONTROL VALVES—C. B. Hunt & Son, Inc. "Quick-as-wink air and hydraulic control valves" bulletin 571 details sliding sleeve air valves, single plunger valves, "B". type valves, etc.

74. SHAFT MACHINES—Wyzenbeek & Staff, Inc. Six-page condensed catalog lists "Wyco" line of flexible shaft, flexible shaft machines, saw attachments, hole cutters and related items.

75. RESISTANCE WELDING — Taylor-Winfield Corp. Bulletin SP-18 shows some of products and assemblies welded electrically by firm.

76. WELDING EQUIPMENT—Raytheon Mfg. Co. List gives description and list price of welders, power supplies, d-c controls, welding heads, accessories, etc.

77. INDUCTION BRAZING—General Electric Co. Bulletin GER-1332 covers advantages of induction brazing, properties, formula for estimating power requirements, etc.

78. ELECTRICAL CONNECTIONS—Erico Products, Inc. Erico Times explains operating efficiency of Cadwell electrical connections.

79. SPOT TIMER—Raytheon Co. Data sheet 2-152 describes model 2-152 (single) and model 2-153 (dual) a-c synchronous spot timers.

80. PUMP PLUNGER—Wall Colmonoy Corp. Volume 2, no. 3 of Colmonoy Alloy News explains how hardfacing alloy increases acidizing pump plunger life 10 times.

81. POWER — Caterpillar Tractor Co. Staying in operation when power fails or disaster strikes is theme of new booklet, form D721 "Power for protection."

82. TIMER—Raytheon Mfg. Co. Heat program timer model 2-151 is featured in data sheet 2-151. General description, application given.

83. X-RAY UNIT—Balteau Electric Corp. Sheet describes "Baltospot 200" industrial x-ray unit.

84. CONTROLS—Raytheon Mfg. Co. Thyratron contractors models 2-154 and 2-155 featured on sheet 2-154. Gives principles of operation.

85. STEEL—Joseph T. Ryerson & Son, Inc. Revised bulletin no. 11-3 describes specially balanced composition for hardness and ductility, supplied in sheet and plate form for equipment subject to abrasion.

86. ALLOY LINERS—Pangborn Corp. Liners for protection of blast cleaner parts subject to abrasive action are described in bulletin 332-B.

87. MOTORS—Allis-Chalmers Mfg. Co. Slides get a magazine treatment in clever booklet showing correct procedures in caring for motors.

88. WELD FASTENERS—Ohio Nut & Bolt Co. 40-page catalog 58 is guide for design and production engineers concerned with metal fabrications and assemblies.

89. HARDFACING ELECTRODES—Metal & Thermit Corp. 20-page booklet tells about line of hardfacing electrodes. Information on how to decrease porosity, cracking, penetration and weld metal dilution with low hydrogen electrodes.

90. BRAZING ALLOYS—Wall Colmonoy Corp. Two-color data sheet no. 16 covers specifications for full range of high temperature brazing alloys.

91. ALLOYS—Westinghouse Electric Corp. Physical properties, applications and shapes of wrought high-temperature alloys listed. Includes welding and heat treatment.

92. ELECTRODE HOLDERS — General Electric Co. GEC-864A provides information on electrode holders, cable connectors and ground clamps.

93. EQUIPMENT—Raytheon Mfg. Co. Attractive bulletin 2-100 lists line of welding equipment including welding heads, controls and power supplies.

94. HELIWELD PROCESS—Air Reduction Sales Co. Complete line of equipment for use in Tig welding illustrated in catalog 2300.

95. SAFETY CLOTHES—C. D. Genter Co. Two-color catalog lists safety apparel including aprons, asbestos gloves, welding curtains, spats.

96. TUNGSTEN PRODUCTS—Sylvania Corp. NWSA index 590 lists types of

meals, standard process and finishes and gives price list.

97. BRAZING—Welding Alloys Mfg. Co. Folder includes aluminum brazing kit, nonspatter compound, welding cable, ground clamps, etc.

98. ELECTRODE HOLDERS—Martin Wells, Inc. Literature includes "Tong-grip" electrode holder, rod saver electrode holder.

99. WELDER—General Electric. D-c generator welder detailed in bulletin GEC-1453. Gives product descriptions, specifications, performance curves on 300- and 400-amp generator welders.

100. CABLES—Carol Cable Co. Price sheet #275 WC-13 (3C2) for arc welding cable.

101. ABRASIVES—Bay State Abrasive Products Co. Catalog gives run down on line of abrasive products. Includes discwheels, grinders.

102. ELECTRODE HOLDERS—Lenco, Inc. Form 457 describes electrode holders for manual arc welding. Includes ground clamps, attachments.

103. METAL SPRAYING—North American Philips Co. Folder covers molybdenum wire for metal spraying applications.

104. HELMETS—Kedman Co. Huntsman line of welding helmets detailed in price sheets. Includes accessories.

105. STEEL WIRE—H. K. Porter, Inc. Bulletin T-1 on stainless steel wire and strip discusses spring properties of precipitation hardening stainless steel.

106. MOTORS—Diehl Mfg. Co. Attractive folder pictures polyphase squirrel cage induction motors and general and special purpose motors.

107. STUDS—Pheoll Mfg. Co. Studs cut own thread, drive and lock in one operation. Leaflet gives design features, advantages.

108. DRILL POSITIONER—Buck Mfg. Co. Mechanical-action drill positioning device fits into portable magnetic drill press unit. Rotates drill point full 330 degrees.

109. METALS—Leach & Garner Co. Colorful booklet gives history of firm in precious and non precious laminated metals. Lists wire, tubing, solder alloys.

110. COPPER WIRE—H. K. Porter Co. Bi-metal wire (nickel-clad copper) provides high electrical and heat conductivity. Bulletin T-3.

111. VALVES—Valcor Engineering Corp. Catalog 105 illustrates types of valves—hydraulic and pneumatic.

112. METAL POWDERS—American Metal Co., Ltd., Handbook C-14 gives information on electrolytic copper, copper-base alloys, tin, solder and precious metals.

113. HOSE—Flexaust Co. Tabbed bulletin 70 gives prices and information on hose and "Portovent" duct products.

114. CHROMIZING—Chromalloy Corp. Process makes iron and steel surfaces resistant to heat, wear and corrosion. Folder explains method.

115. FUSION WELDING—International Nickel Co., Inc. Technical bulletin T-2 treats fusion welding of nickel and high nickel alloys.

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125. Air Products, Inc.—Information on ultra high purity Argon from cylinder to tank car quantities at minimum prices.

126. Air Reduction Sales Co.—Details on the widest selection of "Aircomatic" wire for any kind of inert gas welding.

127. Air Reduction Sales Co.—Complete information on 3 new "Airco" manual Heliweld holders for greater flexibility in Tig arc welding.

128. Air Reduction Sales Co.—Catalog 1318, "Airco Electrode Guide" to help you select the right electrode for your specific job.

129. Allen Co., Inc., L. B.—Information on fluxes for soldering, brazing and welding.

130. Alloy Rods Co.—Complete facts on iron-powder, low-hydrogen "Atom Arc DH-12" electrodes for down hand welding.

131. All-State Welding Alloys Co., Inc.—Write for instruction book on 62 alloys and fluxes.

132. American Brass Co.—Publication B-13, "Anaconda Welding Rods and Procedures for Welding Copper and Copper Alloys," on procedures for various thicknesses.

133. American Platinum Works, Inc.—Information and technical assistance in two complete reference manuals for low-temperature silver-brazing and fluxing.

134. Ampco Metal, Inc.—Bulletin W-17 contains further information on "Ampco-Trode 10" and other Ampco electrodes.

135. Anti-Borax Compound Co.—Sample and circular on cast iron No. 1 welding flux.

136. Aronson Machine Co.—Detailed engineering data on heavy-duty gear driven positioners.

137. Atlas Welding Accessories, Inc.—Full information on complete weld-cleaning tool line.

138. Belden Mfg. Co.—Details on magnet wire, lead and fixture wire, power supply cords, cord sets, portable cord, aircraft wires, welding cable, electrical household cords, electrical wires and automotive wire and cable.

139. Budd Co.—Further information on low-cost, lightweight, portable "Model 40 Iriditron" isotope radiography machine.

140. Burdett Oxygen Co.—Free literature on "Burdox Statosec" cutting machine, industrial gases, gas welding, arc welding, spot welding, soldering, brazing, safety and cutting equipment and accessories.

141. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

142. Contour Marker Corp.—Details on establishing and marking a point at any angle.

143. Crescent Co., Inc.—Information on "Carol Dynapower" arc-welding cable.

144. Crucible Steel Co. of America—Details on automatic welding wire for cleaner, faster, sounder welds.

145. Drawalloy Corp.—Literature and application manual on "Wear-O-Matic" precision drawn hardfacing wires.

146. Engwald Corp.—Application data on welding-fume exhausters.

147. Eutectic Welding Alloys Corp.—Data on high-speed electrodes for gouging, chamfering and piercing all metals without oxygen and details on low-temperature alloys for repairing heavy base castings.

148. Eutectic Welding Alloys Corp.—Details on high-strength, "brazing type" alloy for joining steel and other metals; also alloy for high-tensile strength in repairing; and copper-base, silver-bearing, thin-flow alloy that produces high-strength joints on close fitting operations.

149. Eutectic Welding Alloys Corp.—70-page booklet, "Welding Data Book."

150. Federal Machine & Welder Co.—Full information on "Packaged Production Lines."

151. Flood Safety Products Co.—Data on heat and moisture resistant No. 14 fiber glass and No. p.14 all-plastic ratchet-type helmets.

152. General Cable Corp.—Details on how aluminum welding cable makes your job easier.

153. General Electric Co.—Bulletin GEC-989 on semiautomatic "Fillerarc" gas-shielded welding process.

154. Goldsmith Bros. Smelting & Refining Co.—Free "GB Data Book" gives complete information on low-temperature silver-brazing.

155. H & M Pipe Beveling Machine Co.—Illustrated bulletins on the "H & M" Shape Cutter and new and improved "Out-of-Round" Attachment.

156. Handy & Harman—Bulletin 20 describes high-strength, speed and economy of "Easy-Flo" silver-brazing and details joint design and fast brazing method.

157. Harnischfeger Corp.—Bulletin R-29, "P&H Smootharc Welding Electrodes," gives full description and specification data of iron-powder electrodes.

158. Harnischfeger Corp.—Information on "P&H" iron-powder, low-hydrogen electrodes.

159. Harrisburg Steel Co.—Send for literature and prices, on gas cylinders, specifying with or without caps and valves.

160. Haynes Stellite Div.—Write for "Hard-Facing Manual" on how a Haynes alloy will reduce maintenance and replacement costs.

161. Hobart Bros. Co.—information on a-c/d-c combination with and without inert gas, gas engine drive and electric drive welders.

162. Hobart Bros. Co.—Details on a-c welder/a-c power combinations, "Contractor's Special," "Batam Champ" and "Husky Boy" welders.

163. Hobart Bros. Co.—Data on new "413" electrodes and automatic welding.

164. Hobart Bros. Co.—Complete details on "Rocket 14" new all-position, iron-powder mild steel electrode.

165. Hobart Bros. Co.—Complete electrode catalog.

166. Hobart Bros. Co.—Electrode samples for use on your work.

167. Independent Engineering Co., Inc.—Details on how to reduce cylinder handling with gas supply trailers.

168. International Nickel Co., Inc.—Booklet, "A Handy Guide to Welding Cast Irons" gives useful technical data, case histories and tips on welding methods.

169. Jackson Products—Details on new "Quick-Trik" cable connectors, ground clamps, splicers and lugs for power losses and accidents along your cable lines.

170. Kedman Co.—Information on welding helmets, face shields and accessories.

171. Lenco, Inc.—Details on heat-resistant, completely insulated "Hi-Amp" electrode holders.

172. Lepel High Frequency Laboratories, Inc.—Catalog contains information on high-frequency induction heating units for brazing, annealing, hardening, soldering and melting.

173. Liberty Leasing Corp.—Information on leasing all types of cylinders and equipment.

(Continued on page 92)

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

Also information about

NEW PRODUCTS described on pages 68 to 79

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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ad literature

(Continued from page 90)

174. Linde Co.—Further details on "Unionarc" welding, inert-gas shielded arc welding, submerged arc welding, shielded inert-gas metal arc welding and new magnetic flux gas shielded arc welding.

175. Mallory & Co., Inc., P. R.—Information on selection of standard welding electrodes, in a diversified line of sizes, shapes and alloys.

176. Merrill Bros.—Information on lifting clamps, twin and drum lifters, drum tilter and other material handling devices.

177. Metal & Thermit Corp.—Details on "Murex" mild-steel, low-alloy electrodes; "Hardex" new low-hydrogen, hardfacing electrodes; automatic and manual welding machines and accessories.

178. Miller Electric Mfg. Co., Inc.—Complete particulars on "Gold Star SR" d-c arc welder, including inert gas and automatic fixture welding.

179. Miller Electric Mfg. Co., Inc.—Information on perfection in d-c welding preformance with the "Gold Star SR" welder.

180. National Carbide Co.—Write for name and address of nearest supplier.

181. National Cylinder Gas Co.—Details on cutting, welding, brazing and metal conditioning with automatic flame, cutting machines, gases, "Sureweld" a-c shop welders, a-c industrial welders, d-c portable welder, d-c rectifier welders, inert arc welders and a-c/d-c combination welders.

182. National-U. S. Radiator Corp.—Technical data and working sample of "Plast-Iron" Grade B-171 powder for mild steel, low-hydrogen and hardfacing electrodes.

183. National Welding Equipment Co.—Details on regulators for measuring pressure, and flow for gases for welding or flame cutting

184. Nickelson Tool & Die Co.—Descriptive folder on "Woerner" tubular profile cutter.

185. Norris-Thermador Corp.—Specifications, sizes and prices of acetylene cylinders.

186. Page Steel & Wire Div.—Folder DH-402A on submerged-arc and inert-gas welding wire.

187. Page Steel & Wire Div.—Booklet DH-1277 on gas welding rods.

188. Page Steel & Wire Div.—Send for "Welding Rod Comparison Chart."

189. Phoenix Products Co.—Information on "Dry Rod" electrode ovens.

190. Rankin Mfg. Co.—Complete information and "Comparison Chart" on "Ranite" hardfacing welding rods for every type application.

191. Robotron Corp.—New bulletin, "Electronics For You . . . From Robotron."

192. Smith Corp., A. O.—Details on how "C-OMANUAL" method can help you guard against production holdups.

193. Square D Co.—Write for Bulletin 8990 on improved non-synchronous performance with new slope control.

194. Stulz-Sickles Co.—Complete details and price list on "Manganal" round applicator bars.

195. Superior Welding Co.—Details on distributorships and information on how bench model "Positioner-Turntable" speeds-up welding.

196. Sylvania Electric Products, Inc.—Details on complete line of Tig color-coded electrodes for shileded arc welding.

197. Tee Torch Co., Inc.—Information on "Visuweld" torches for Tig welding.

198. Tempil Corp.—Sample pellets and booklet, "How Temperatures are Measured."

199. Tennessee Fabricating Co.—32-page catalog, "Everything for the Ornamental Iron Shop."

200. Thermacote Co.—Information on "Thermo" spiral tip cleaners.

201. Tillman & Co., John—Catalog on weldor's gloves and garments.

202. United Specialties, Inc.—Complete information on "Weldreel" welding hose and cable reels.

203. United States Steel Corp.—New booklet, "USS T-1 Steel," on where and when to use it.

204. Victor Equipment Co.—Details on torch for hot, tough jobs that last longer.

205. Westinghouse Electric Corp.—Trial packages and details on new brazing alloys.

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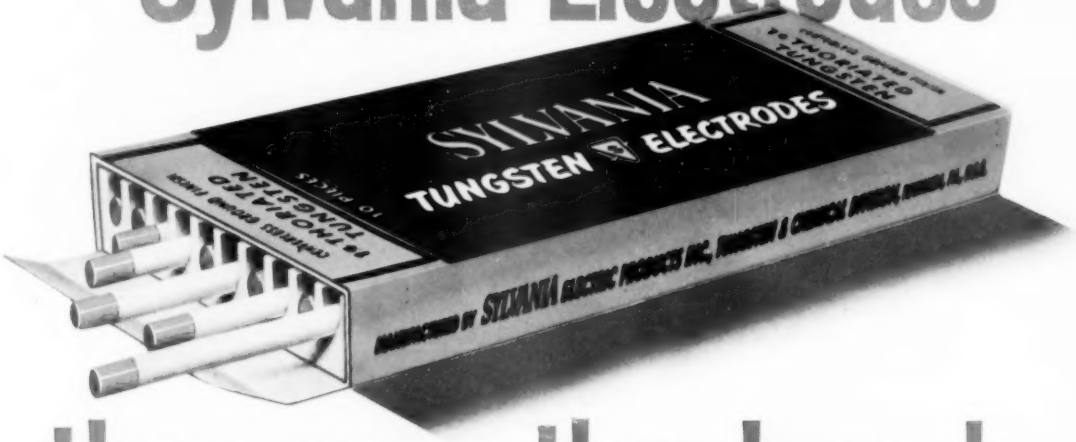

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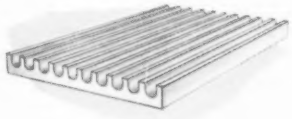

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ONLY Sylvania has the complete line of tungsten electrodes for shielded arc welding! Whichever gas you're using and whatever type metal you're welding—the four dependable Sylvania electrodes will effectively meet almost any condition you may encounter.

For greater economy, safety, and convenience—Sylvania Tungsten Electrodes are color-coded. You can tell the type of rod merely by glancing at the end. Partially used rods, regardless of length, no longer need to be scrapped for lack of identification. And no longer do you risk ruining a costly job because of choosing the wrong electrode.

Sylvania electrodes are cradled in a protective wood filler and packed ten to the box. Each package carries a color-coded label for easy identification. They're available through leading welding supply distributors only.

SYLVANIA ELECTRIC PRODUCTS INC.
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WELDING ROD CLINIC

J. Imperati and R. F. Pulver, Welding Engineers
The American Brass Company, Waterbury, Conn.

Satisfactory welding of copper bus bars

Anaconda Copper-372 Welding Rod is superior to high conductivity copper rods.

Bolted connections are the general rule in bus bar installations due to the requirements of final assembly. But there are many instances where permanent connections are made in the fabrication of individual components. When brazing is employed for this purpose, it is necessary to lap the ends of the conductors to obtain the bonded area desired.

Welded joints, however, can be used to effect savings in joint material and bus bar, at the same time adding but little to the dimensions of the conductors at the joints.

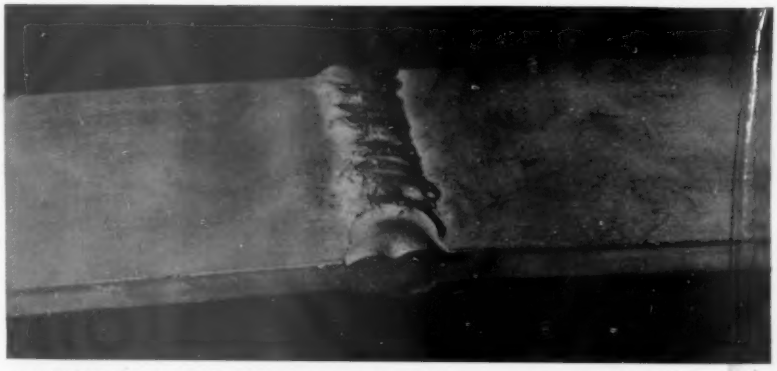
The belief that high-conductivity weld metals must be used has been a deterrent to more frequent welding. However, the volume of weld metal in a joint represents but a small percentage of the conductor, and, even if made with a low-conductivity metal, has very little effect on the over-all resistance.

Weld metal resistance negligible. This is illustrated by the figures below, which are the resistances measured on ½"-wide sections cut from a welded ¼"-thick conductor. Weld was made with Anaconda Copper-372 Welding Rod using the inert-gas tungsten-arc process.

	RESISTANCE, OHMS	
Test Length	Across the Weld	Unwelded Bar
One Meter	0.0002145	0.0002136
Two Inches	0.00001319	0.00001085

It is obvious that, when measured over lengths of several feet, the increase in resistance caused by the weld is negligible. In addition, the high heat conductivity of the adjacent base metal eliminates any tendency to produce hot spots.

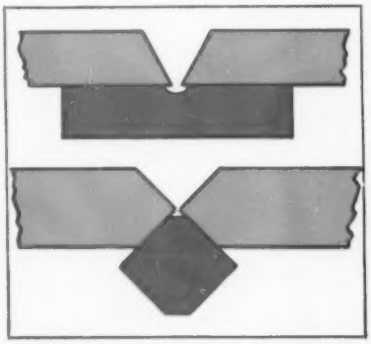
This is one reason why many of the large copper bus installations during recent years have been welded with Anaconda Copper-372 Welding Rod. Their excellent performance has shown that there is no need to forego the advantages of welded joints.



TYPICAL WELD in high-conductivity copper bus bar with Anaconda Copper-372 Rod. Weld metal is free from porosity—adds little to the thickness of the conductor at the joint.

Anaconda Copper-372 Welding Rod is a superior filler metal for this application because:

1) Dilution with the base metal and freedom from porosity counteract any tendency to develop excessive resistance.
2) The high-conductivity coppers, which are readily available for use as filler metals, cannot be expected to deposit sound weld metal. Any electrical advantage they might have is offset by the reduction of effective cross section due to weld-metal porosity.



SINGLE-VEE GROOVE (top) is suggested when bus bars are from ⅛" thick to ¾" thick. Double-vee groove should be used for bars ¾" thick and over.

Welding methods. The inert-gas arc processes are preferred for welding copper conductors. Helium develops higher heat levels than argon and improves the flowing properties of the weld metal, and is suggested as the shielding gas for tungsten-arc welding. Argon is the usual shield in the consumable-electrode process. When thicknesses exceed ⅛" the joint ends should be beveled, and single-vee grooves with 90-degree included angle are the rule. Unless welding can be done from both sides, to insure fusion of the whole cross section, grooved copper backing bars should be employed on the underside of each joint. The sleeves used in tubular bus serve the same purpose. Welding must be done down hand.

For more information. Details of procedures for various thicknesses are given in Anaconda Publication B-13, "Anaconda Welding Rods and Procedures for Welding Copper and Copper Alloys." For a copy, write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 7112

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